Faculty of Science & Technology
Savitribai Phule Pune University, Pune
Maharashtra, India

Curriculum for
Second Year of Information Technology
(2019 Course)
(With effect from AY 2020-21)

http://www.unipune.ac.in/
## I N D E X

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Name of the Course</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>SEMESTER - III</strong></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Program Educational Objectives</td>
<td>03</td>
</tr>
<tr>
<td>2</td>
<td>Program Outcomes</td>
<td>04</td>
</tr>
<tr>
<td>3</td>
<td>Program Specific Outcomes</td>
<td>05</td>
</tr>
<tr>
<td>4</td>
<td>Syllabus Structure</td>
<td>06</td>
</tr>
<tr>
<td>5</td>
<td>Instructions</td>
<td>08</td>
</tr>
<tr>
<td>6</td>
<td>Discrete Mathematics</td>
<td>10</td>
</tr>
<tr>
<td>7</td>
<td>Logic Design and Computer Organization</td>
<td>16</td>
</tr>
<tr>
<td>8</td>
<td>Data Structures and Algorithms</td>
<td>19</td>
</tr>
<tr>
<td>9</td>
<td>Object Oriented Programming</td>
<td>22</td>
</tr>
<tr>
<td>10</td>
<td>Basics of Computer Network</td>
<td>25</td>
</tr>
<tr>
<td>11</td>
<td>Logic Design and Computer Organization Lab</td>
<td>28</td>
</tr>
<tr>
<td>12</td>
<td>Data Structures and Algorithms Lab</td>
<td>31</td>
</tr>
<tr>
<td>13</td>
<td>Object Oriented Programming Lab</td>
<td>35</td>
</tr>
<tr>
<td>14</td>
<td>Soft Skill Lab</td>
<td>39</td>
</tr>
<tr>
<td>15</td>
<td>Mandatory Audit Course -3</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td><strong>SEMESTER - IV</strong></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Engineering Mathematics- III</td>
<td>54</td>
</tr>
<tr>
<td>17</td>
<td>Processor Architecture</td>
<td>56</td>
</tr>
<tr>
<td>18</td>
<td>Database Management System</td>
<td>58</td>
</tr>
<tr>
<td>19</td>
<td>Computer Graphics</td>
<td>61</td>
</tr>
<tr>
<td>20</td>
<td>Software Engineering</td>
<td>64</td>
</tr>
<tr>
<td>21</td>
<td>Programming Skill Development Lab</td>
<td>67</td>
</tr>
<tr>
<td>22</td>
<td>Database Management System Lab</td>
<td>70</td>
</tr>
<tr>
<td>23</td>
<td>Computer Graphics Lab</td>
<td>73</td>
</tr>
<tr>
<td>24</td>
<td>Project Based Learning</td>
<td>76</td>
</tr>
<tr>
<td>25</td>
<td>Mandatory Audit Course - 4</td>
<td>79</td>
</tr>
</tbody>
</table>
Savitribai Phule Pune University, Pune  
Bachelor of Information Technology  

<table>
<thead>
<tr>
<th>Program Educational Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PEO1</strong></td>
</tr>
<tr>
<td><strong>PEO2</strong></td>
</tr>
<tr>
<td><strong>PEO3</strong></td>
</tr>
<tr>
<td><strong>PEO4</strong></td>
</tr>
<tr>
<td><strong>PEO5</strong></td>
</tr>
</tbody>
</table>
## Program Outcomes

Students are expected to know and be able to–

<table>
<thead>
<tr>
<th>PO1</th>
<th>Engineering Knowledge</th>
<th>An ability to apply knowledge of mathematics, computing, science, engineering and technology.</th>
</tr>
</thead>
<tbody>
<tr>
<td>PO2</td>
<td>Problem Analysis</td>
<td>An ability to define a problem and provide a systematic solution with the help of conducting experiments, analyzing the problem and interpreting the data.</td>
</tr>
<tr>
<td>PO3</td>
<td>Design/Development of Solutions</td>
<td>An ability to design, implement, and evaluate a software or a software/hardware system, component, or process to meet desired needs within realistic constraints.</td>
</tr>
<tr>
<td>PO4</td>
<td>Conduct Investigations of Complex Problems</td>
<td>An ability to identify, formulates, and provides systematic solutions to complex engineering/Technology problems.</td>
</tr>
<tr>
<td>PO5</td>
<td>Modern Tool Usage</td>
<td>An ability to use the techniques, skills, and modern engineering technology tools, standard processes necessary for practice as a IT professional.</td>
</tr>
<tr>
<td>PO6</td>
<td>The Engineer and Society</td>
<td>An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems with necessary constraints and assumptions.</td>
</tr>
<tr>
<td>PO7</td>
<td>Environment and Sustainability</td>
<td>An ability to analyze and provide solution for the local and global impact of information technology on individuals, organizations and society.</td>
</tr>
<tr>
<td>PO8</td>
<td>Ethics</td>
<td>An ability to understand professional, ethical, legal, security and social issues and responsibilities.</td>
</tr>
<tr>
<td>PO9</td>
<td>Individual and Team Work</td>
<td>An ability to function effectively as an individual or as a team member to accomplish a desired goal(s).</td>
</tr>
<tr>
<td>PO10</td>
<td>Communication Skills</td>
<td>An ability to engage in life-long learning and continuing professional development to cope up with fast changes in the technologies/tools with the help of electives, professional organizations and extra-curricular activities.</td>
</tr>
<tr>
<td>PO11</td>
<td>Project Management and Finance</td>
<td>An ability to communicate effectively in engineering community at large by means of effective presentations, report writing, paper publications, demonstrations.</td>
</tr>
<tr>
<td>PO12</td>
<td>Life-long Learning</td>
<td>An ability to understand engineering, management, financial aspects, performance, optimizations and time complexity necessary for professional practice.</td>
</tr>
<tr>
<td>Program Specific Outcomes (PSO)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------------------------</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>A graduate of the Information Technology Program will demonstrate-</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>PSO1</strong></td>
<td>An ability to apply the theoretical concepts and practical knowledge of Information Technology in analysis, design, development and management of information processing systems and applications in the interdisciplinary domain.</td>
<td></td>
</tr>
<tr>
<td><strong>PSO2</strong></td>
<td>An ability to analyze a problem, and identify and define the computing infrastructure and operations requirements appropriate to its solution. IT graduates should be able to work on large-scale computing systems.</td>
<td></td>
</tr>
<tr>
<td><strong>PSO3</strong></td>
<td>An understanding of professional, business and business processes, ethical, legal, security and social issues and responsibilities.</td>
<td></td>
</tr>
<tr>
<td><strong>PSO4</strong></td>
<td>Practice communication and decision-making skills through the use of appropriate technology and be ready for professional responsibilities.</td>
<td></td>
</tr>
<tr>
<td>Course Code</td>
<td>Course Name</td>
<td>Teaching Scheme (Hours/Week)</td>
</tr>
<tr>
<td>-------------</td>
<td>--------------------------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Theory</td>
</tr>
<tr>
<td>214441</td>
<td>Discrete Mathematics</td>
<td>03</td>
</tr>
<tr>
<td>214442</td>
<td>Logic Design and Computer Organization</td>
<td>03</td>
</tr>
<tr>
<td>214443</td>
<td>Data Structures and Algorithms</td>
<td>03</td>
</tr>
<tr>
<td>214444</td>
<td>Object Oriented Programming</td>
<td>03</td>
</tr>
<tr>
<td>214445</td>
<td>Basics of Computer Network</td>
<td>03</td>
</tr>
<tr>
<td>214446</td>
<td>Logic Design Computer Organization Lab</td>
<td>-</td>
</tr>
<tr>
<td>214447</td>
<td>Data Structures and Algorithms Lab</td>
<td>-</td>
</tr>
<tr>
<td>214448</td>
<td>Object Oriented Programming Lab</td>
<td>-</td>
</tr>
<tr>
<td>214449</td>
<td>Soft Skill Lab</td>
<td>-</td>
</tr>
<tr>
<td>214450</td>
<td>Mandatory Audit Course 3</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>15</td>
</tr>
</tbody>
</table>

**Abbreviations:**
- TH: Theory
- TW: Term Work
- PR: Practical
- OR: Oral
- TUT: Tutorial

**Note:** Students of S.E. (Information Technology) can opt any one of the audit course from the list of audit courses prescribed by BoS (Information Technology)

#Mandatory Audit Course 3:
1. **214450A**: Ethics and values in IT
2. **214450B**: Quantitative Aptitude and Logical Reasoning
3. **214450C**: Language Study- Japanese- Module
4. **214450D**: Cyber Security and Law
### Second Year of Information Technology Engineering (2019 Course)

**Semester-IV**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Teaching Scheme (Hours/Week)</th>
<th>Examination Scheme and Marks</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Theory</td>
<td>Practical</td>
<td>Tutorial</td>
</tr>
<tr>
<td>207003</td>
<td>Engineering Mathematics- III</td>
<td>03</td>
<td>-</td>
<td>01</td>
</tr>
<tr>
<td>214451</td>
<td>Processor Architecture</td>
<td>03</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>214452</td>
<td>Database Management System</td>
<td>03</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>214453</td>
<td>Computer Graphics</td>
<td>03</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>214454</td>
<td>Software Engineering</td>
<td>03</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>214455</td>
<td>Programming Skill Development Lab</td>
<td>-</td>
<td>02</td>
<td>-</td>
</tr>
<tr>
<td>214456</td>
<td>Database Management System Lab</td>
<td>-</td>
<td>04</td>
<td>-</td>
</tr>
<tr>
<td>214457</td>
<td>Computer Graphics Lab</td>
<td>-</td>
<td>02</td>
<td>-</td>
</tr>
<tr>
<td>214458</td>
<td>Project Based Learning</td>
<td>-</td>
<td>04</td>
<td>-</td>
</tr>
<tr>
<td>214459</td>
<td>Mandatory Audit Course 4</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td>15</td>
<td>12</td>
<td>01</td>
</tr>
</tbody>
</table>

**Abbreviations:**
- TH: Theory
- TW: Term Work
- PR: Practical
- OR: Oral
- TUT: Tutorial

**Note:** Students of SE (Information Technology) can opt any one of the audit course from the list of audit courses prescribed by BoS (Information Technology)

#Mandatory Audit Course 4:
- **214459A** - Water Supply and Treatment
- **214459B** - Language Study- Japanese- Module II
- **214459C** - Waste Management and Pollution Control
- **214459D** - Intellectual Property Rights
INSTRUCTIONS

- Practical or Tutorial must be conducted in batches and number of batches per division should be as per guidelines from regulatory bodies.
- Required minimum number of experiments/assignments in practical/tutorial shall be conducted as mentioned in the syllabi of respective subjects. The list of experiments/assignments is prescribed in the syllabi.
- In addition to the prescribed list, the instructor for practical/tutorial may design one or two additional experiments/assignments relating to the subject covering some of the research/application areas of the concerned subject.
- For practical/tutorial subject, each experiment/assignment, the student must prepare a write-up consisting of assignment statement, objective(s)/outcome(s), algorithm(s), flow charts/UML diagram(s), important test cases, test case validation report etc.
- The faculty member/instructor should prepare a rubric for the assessment of practical and tutorial. Assessment of tutorial work is part of term-work examination. Term-work Examination at second year of engineering course shall be internal continuous assessment only.
- Project based learning (PBL) requires mentoring and internal continuous assessment by faculty throughout the semester for successful completion of the tasks assigned to the students. A teaching workload of 4 hours/week/batch is associated with PBL subject should be allocated to the faculty conducting PBL mentoring and internal continuous assessment. The students in a Batch may be divided into sub-groups of 5 to 6 students for easing the process of internal continuous assessment. Assignments/activities/models/projects etc. completed under project-based learning will be considered for internal continuous assessment, evaluation, and award of credits for PBL subjects.
- Audit course is a mandatory non-credit course. The faculty member should prepare the rubric(s) for the assessment of audit course at the start of semester. The assessment should be carried out based on the said rubric(s) only and report should be prepared and submitted to the department at the end of semester.
- Case Studies may be assigned as a self-study to students and to be excluded from theory examinations.
- All the rules, regulations and guidelines issued by regulatory authorities from time to time for effective conduction of curriculum, assessment and evaluation are to be strictly followed.
SEMESTER – III
Savitribai Phule Pune University, Pune
Second Year Information Technology (2019 Course)

214441: Discrete Mathematics

Teaching Scheme: 
Theory (TH) : 03 hrs/week
Tutorial(TUT): 01 hrs/week

Credit Scheme: 
03
01

Examination Scheme: 
Mid_Semester : 30 Marks
End_Semester : 70 Marks
Term Work : 25 Marks

Prerequisite Courses, if any: Basic Mathematics

Companion Course, if any:

Course Objectives:
1. To gain sound knowledge to formulate and solve problems with sets and propositions.
2. To understand and solve counting problems by applying elementary counting techniques to solve problems of discrete probability.
3. To understand Graph and Tree terminologies and models to be applied in real life problems.
4. To recognize types of relation, formulate and solve problems with relations and functions.
5. To understand basics of number theory and its applications.
6. To understand the various types’ algebraic structures and its applications.

Course Outcomes:
On completion of the course, students will be able to–

CO1: Formulate and apply formal proof techniques and solve the problems with logical reasoning.
CO2: Analyze and evaluate the combinatorial problems by using probability theory.
CO3: Apply the concepts of graph theory to devise mathematical models.
CO4: Analyze types of relations and functions to provide solution to computational problems.
CO5: Identify techniques of number theory and its application.
CO6: Identify fundamental algebraic structures.

COURSE CONTENTS

Unit I Sets And Propositions (06 hrs + 2 hrs Tutorial)
Sets: Sets, Combinations of Sets, Venn Diagram, Finite and Infinite Sets, Countable Sets, Multisets, Principle of Inclusion and Exclusion, Mathematical Induction.
Propositions: Propositions, Logical Connectives, Conditional and Bi-conditional Propositions, Logical Equivalence, Validity of Arguments by using Truth Tables, Predicates and Quantifiers, Normal forms. Applications of Sets and Propositions.

Mapping of Course Outcomes for Unit I

CO1

Unit II Combinatorics And Discrete Probability (06 hrs + 2 hrs Tutorial)
Combinatorics: Rules of Sum and Product, Permutations, Combinations.
### Mapping of Course Outcomes for Unit II

<table>
<thead>
<tr>
<th>CO2</th>
<th>Unit III</th>
<th>Graph Theory</th>
<th>(06 hrs + 2hrs Tutorial)</th>
</tr>
</thead>
</table>

**Graphs:** Basic Terminologies, Multi-Graphs, Weighted Graphs, Sub Graphs, Isomorphic graphs, Complete Graphs, Regular Graphs, Bipartite Graphs, Operations on Graphs, Paths, Circuits, Hamiltonian and Eulerian graphs, Travelling Salesman Problem, Factors of Graphs, Planar Graphs, Graph Colouring.

**Trees:** Tree Terminologies, Rooted Trees, Path Length in Rooted Trees, Prefix Codes, Spanning Trees, Fundamental Cut Sets and Circuits, Max flow –Min Cut Theorem (Transport Network).

Applications of Graph Theory.

### Mapping of Course Outcomes for Unit III

<table>
<thead>
<tr>
<th>CO3</th>
<th>Unit IV</th>
<th>Relations And Functions</th>
<th>(06 hrs + 2hrs Tutorial)</th>
</tr>
</thead>
</table>

**Relations:** Properties of Binary Relations, Closure of Relations, Warshall’s Algorithm, Equivalence Relations, Partitions, Partial Ordering Relations, Lattices, Chains and Anti Chains.

**Functions:** Functions, Composition of Functions, Invertible Functions, Pigeonhole Principle, Discrete Numeric Functions.

**Recurrence Relations:** Recurrence Relation, Linear Recurrence Relations with Constant Coefficients, Total Solutions, Applications of Relations and Functions.

### Mapping of Course Outcomes for Unit IV

<table>
<thead>
<tr>
<th>CO4</th>
<th>Unit V</th>
<th>Introduction To Number Theory</th>
<th>(06 hrs + 2hrs Tutorial)</th>
</tr>
</thead>
</table>

**Divisibility of Integers:** Properties of Divisibility, Division Algorithm, Greatest Common Divisor GCD and its Properties, Euclidean Algorithm, Extended Euclidean Algorithm, Prime Factorization Theorem, Congruence Relation, Modular Arithmetic, Euler Phi Function, Euler’s Theorem, Fermat’s Little Theorem, Additive and Multiplicative Inverses, Chinese Remainder Theorem.

### Mapping of Course Outcomes for Unit V

<table>
<thead>
<tr>
<th>CO5</th>
<th>Unit VI</th>
<th>Algebraic Structures</th>
<th>(06 hrs + 2hrs Tutorial)</th>
</tr>
</thead>
</table>

**Algebraic Structures:** Introduction Semigroup, Monoid, Group, Abelian Group, Permutation Groups, Cosets, Normal Subgroup, Codes and Group Codes, Ring, Integral Domain, Field.

Applications of Algebraic Structures.

### Mapping of Course Outcomes for Unit VI

<table>
<thead>
<tr>
<th>CO6</th>
<th>Text Books:</th>
</tr>
</thead>
</table>

Reference Books:

Guidelines for Tutorial and Term Work

- Tutorial shall be engaged in four batches (batch size of 20 students maximum) per division.
- Term work shall be based on continuous assessment of six assignments (one per each unit) and performance in internal tests.

Examples on various topics of respective unit must be explained and discussed will be covered in tutorial sessions based on following:

1. Problems for deep understanding of concepts.
2. Identify applications and device mathematical models for real time problems.

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Name of the Tutorial</th>
<th>Description</th>
<th>Applicable CO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction to Set Theory</td>
<td>Formulate problems to illustrate 1. Sets, universal sets, multisets, and operations on sets such as union, intersection, complement and set difference. 2. Introduce sets as mathematical model to classify data sets.</td>
<td>CO1</td>
</tr>
<tr>
<td>2</td>
<td>Propositional Logic</td>
<td>Formulate problems that comprises 1. Translation of English sentences into logical propositions by using logical connectives. 2. Proof for logical equivalences by using truth table analysis. 3. Propositions by using Predicates and Quantifiers. 4. Conjunctive and Disjunctive Normal Forms. 5. Proof by using Mathematical Induction</td>
<td>CO1</td>
</tr>
<tr>
<td>3</td>
<td>Combinatorics</td>
<td>Design problems to illustrate counting techniques by using 1. Permutation and Combinations 2. Permutation with repetition</td>
<td>CO2</td>
</tr>
<tr>
<td>Sr. No.</td>
<td>Tutorial</td>
<td>Description</td>
<td>Applicable CO</td>
</tr>
<tr>
<td>---------</td>
<td>---------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>3</td>
<td>Properties of $nCr$ and $nPr$</td>
<td>4. Addition and Multiplication Principle</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Discrete Probability</td>
<td>3. Formulate problems for better understanding of 1. Discrete Probability 2. Conditional Probability and Bay’s theorem Identify applications of probability to Computer Science</td>
<td>CO2</td>
</tr>
<tr>
<td>5</td>
<td>Graph Theory</td>
<td>4. Design problems to study 1. Graph properties and operations on graphs 2. Connectedness, Hamiltonian and Eulerian graphs. 3. Introduce graph as a mathematical model to understand transport, communication, and social networks.</td>
<td>CO3</td>
</tr>
<tr>
<td>7</td>
<td>Relations and Functions</td>
<td>4. Problems to understand 1. Types of Relations 2. Equivalence relation and Equivalence classes 3. Transitive closure by using Warshall’s Algorithm. 4. Injective, Surjective and Bijective Functions. 5. Pigeonhole principle and its applications</td>
<td>CO4</td>
</tr>
<tr>
<td>9</td>
<td>Introduction to Number Theory</td>
<td>6. Problems to illustrate concepts such as- 1. Divisibility and its properties 2. Greatest common divisor and its properties 3. Prime numbers and prime factorization theorem to find GCD and LCM of two numbers</td>
<td>CO5</td>
</tr>
<tr>
<td>Sr. No.</td>
<td>Name of the Tutorial</td>
<td>Description</td>
<td>Applicable CO</td>
</tr>
<tr>
<td>---------</td>
<td>---------------------</td>
<td>-------------</td>
<td>---------------</td>
</tr>
<tr>
<td>11</td>
<td>Algebraic Structures-I</td>
<td>Problems to be formulated to illustrate 1. Concept of algebraic structure 2. Examples of semigroup, monoid, group and abelian group 3. Generating group codes by using normal subgroups 4. Application of Algebraic Structure in operator overloading.</td>
<td>CO6</td>
</tr>
<tr>
<td>12</td>
<td>Algebraic Structures-II</td>
<td>Problems to illustrate 1. Definition and examples of Ring, types of Ring 2. Zero divisors and Integral domain 3. Multiplicative inverses in different rings, and Field 4. Identify Applications of Ring and Field in Coding Theory</td>
<td>CO6</td>
</tr>
</tbody>
</table>

* Subject Teacher can design different tasks to students as well can accept the student ideas within the above stated guidelines.

**Case Study**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Unit</th>
<th>Case Study</th>
<th>Description</th>
<th>Applicable CO</th>
</tr>
</thead>
</table>
| 1       | Unit-I  | Apply rules of logic to explain Barber’s paradox, The Lair’s paradox | i. Discuss logical paradoxes like, Jourdain’s card paradox, Barber’s paradox, The Lair’s paradox etc. by using rules of mathematical logic. Explain how these paradoxes are resolved  
ii. Describe the limitations of classical logic and how fuzzy logic is applied to practical applications | CO1 |
| 2       | Unit-II | Demonstrate counting techniques to form telephone numbering plan. | i. Discuss ways in which telephone numbering plan can be extended to accommodate the rapid demand for more telephone numbers, for each numbering plan find how different telephone numbers can be formed. | CO2 |
| 3       | Unit-III| Model a social network group as a connected graph and study simple properties of graphs | i. Investigate the properties of web graph, analyze web graphs by correlating the graph theoretic concepts with properties of web graph  
ii. Construct a social network graph, for example graph for WhatsApp group | CO3 |
<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Unit</th>
<th>Case Study</th>
<th>Description</th>
<th>Applicable CO</th>
</tr>
</thead>
</table>
| 4       | Unit-IV | Demonstrate the correlation of the concept of relations with the relational database | i. Describe basic principles of relational databases. Find the correlation between relational databases and relations that you have studied.  
ii. Describe the importance of fuzzy relations in smart applications  
iii. Built input-output models by using function for simple machines. | CO4           |
| 5       | Unit-V | Generate a public key cryptosystem with small primes \( p, q \) for a set of alphabets. | i. Apply the number theoretic concepts to generate public keys and private keys for public key cryptography  
ii. Find the day of the week for any given date by using congruence relation. | CO5           |
| 6       | Unit-VI | Demonstrate the application of group properties in generating group codes. | i. Correlate the properties of binary operation with operator overloading.  
ii. Identify applications of encoding-decoding functions in satellite communication. | CO6           |
Savitribai Phule Pune University, Pune
Second Year Information Technology (2019 Course)

214442: Logic Design & Computer Organization

Teaching Scheme:  
Credit Scheme:  
Examination Scheme:

Theory (TH): 03hrs/week  
3  
Mid_Semester: 30 Marks  
End_Semester: 70 Marks

Prerequisite Courses, if any: Basics of electronics engineering

Companion Course, if any:

Course Objectives:
1. To make undergraduates, aware of different levels of abstraction of computer systems from hardware perspective.
2. To make undergraduates, understand the functions, characteristics of various components of Computer & in particular processor & memory.

Course Outcomes:
On completion of the course, students will be able to–

CO1: Perform basic binary arithmetic & simplify logic expressions.

CO2: Grasp the operations of logic ICs and Implement combinational logic functions using ICs.

CO3: Comprehend the operations of basic memory cell types and Implement sequential logic functions using ICs.

CO4: Elucidate the functions & organization of various blocks of CPU.

CO5: Understand CPU instruction characteristics, enhancement features of CPU.

CO6: Describe an assortment of memory types (with their characteristics) used in computer systems and basic principle of interfacing input, output devices.

COURSE CONTENTS

Mapping of Course Outcomes for Unit I

<table>
<thead>
<tr>
<th>Unit 1</th>
<th>CO1 Introduction To Digital Electronics</th>
<th>06 hrs</th>
</tr>
</thead>
</table>

Digital Logic families: Digital IC Characteristics; TTL: Standard TTL characteristics, Operation of TTL NAND gate; CMOS: Standard CMOS characteristics, operation of CMOS NAND gate; Comparison of TTL & CMOS.

Signed Binary number representation and Arithmetic: Sign Magnitude, 1’s complement & 2’s complement representation, unsigned Binary arithmetic (addition, subtraction, multiplication, and division), subtraction using 2’s complement; IEEE Standard 754 Floating point number representations.

Codes: Binary, BCD, octal, hexadecimal, Excess-3, Gray code & their conversions

Logic minimization: Representation of logic functions: logic statement, truth table, SOP form, POS form; Simplification of logical functions using K-Maps up to 4 variables.
### Case Study:
1) CMOS 4000 series ICs  
2) practical applications of various codes in computers  
3) four basic arithmetic operations using floating point numbers in a calculator.

<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit I</th>
<th>CO1</th>
</tr>
</thead>
</table>

#### Unit 2  
**Combinational Logic Design**  
**06 hrs**

**Introduction to MSI chips**: Multiplexer (IC 74153), Demultiplexer (IC 74138), Decoder (74243) Encoder (IC 74147), Binary adder (IC 7483)  
**Design using MSI chips**: BCD adder & subtractor using IC 7483, Implementation of logic functions using IC 74153 & 74138.

**Case Study**: Use of combinational logic design in 7 segment display interface

<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit II</th>
<th>CO2</th>
</tr>
</thead>
</table>

#### Unit 3  
**Sequential Logic Design**  
**06 hrs**

**Introduction** to sequential circuits: Difference between combinational circuits and sequential circuits; Memory element-latch & Flip-Flop.  
**Flip- Flops**: Logic diagram, truth table & excitation table of SR, JK, D, T flip flops; Conversion from one FF to another, Study of flip flops with regard to asynchronous and synchronous, Preset & Clear, Master Slave configuration; Study of 7474, 7476 flip flop ICs.  
**Application of flip-flops**: Counters- asynchronous, synchronous and modulo n counters, study of 7490 modulus n counter ICs & their applications to implement mod counters; Registers- shift register types (SISO, SIPO, PISO & PIPO) & applications.

**Case Study**: Use of sequential logic design in a simple traffic light controller

<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit III</th>
<th>CO3</th>
</tr>
</thead>
</table>

#### Unit 4  
**Computer Organization & Processor**  
**06 hrs**

**Computer organization & computer architecture**, organization, functions & types of computer units- CPU(typical organization, Functions, Types), Memory (Types & their uses in computer), IO( types & functions) & system bus( Address, data & control, Typical control lines, Multiple-Bus Hierarchies); Von Neumann & Harvard architecture; Instruction cycle  
**Processor**: Single bus organization of CPU; ALU( ALU signals, functions & types); Register (types & functions of user visible, control & status registers such as general purpose, address registers, data registers, flags, PC, MAR, MBR, IR) & control unit (control signals & typical organization of hard wired & microprogrammed CU).  
Micro Operations (fetch, indirect, execute, interrupt) and control signals for these micro operations.

**Case Study**: 8086 processor, PCI bus
Mapping of Course Outcomes for Unit IV

<table>
<thead>
<tr>
<th>CO4</th>
<th>Processor Instructions &amp; Processor Enhancements</th>
<th>06 hrs</th>
</tr>
</thead>
</table>

**Unit 5**

**Instruction**: elements of machine instruction; instruction representation (Opcode & mnemonics, Assembly language elements); Instruction Format & 0-1-2-3 address formats, Types of operands

Addressing modes; Instruction types based on operations (functions & examples of each); key characteristics of RISC & CISC; Interrupt: its purpose, types & classes & interrupt handling (ISR, multiple interrupts), exceptions; instruction pipelining (operation & speed up)

Multiprocessor systems: Taxonomy of Parallel Processor Architectures, two types of MIMD clusters & SMP (organization & benefits) & multicore processor (various Alternatives & advantages of multicores), typical features of multicore Intel Core i7.

**Case Study**: 8086 Assembly language programming

Mapping of Course Outcomes for Unit V

<table>
<thead>
<tr>
<th>CO5</th>
<th>Memory &amp; Input / Output Systems</th>
<th>06 hrs</th>
</tr>
</thead>
</table>

**Unit 6**

**Memory Systems**: Characteristics of Memory Systems, Memory Hierarchy, signals to connect memory to processor, memory read & write cycle, characteristics of semiconductor memory: SRAM, DRAM & ROM, Cache **Memory** — Principle of Locality, Organization, Mapping functions, write policies, Replacement policies, Multilevel Caches, Cache Coherence,


**Case Study**: USB flash drive

Mapping of Course Outcomes for Unit VI

<table>
<thead>
<tr>
<th>CO6</th>
<th>Text Books</th>
</tr>
</thead>
</table>

**Text Books**:


**Reference Books**:

**Savitribai Phule Pune University, Pune**  
**Second Year Information Technology (2019 Course)**  
**214443: Data Structure & Algorithms**

<table>
<thead>
<tr>
<th>Teaching Scheme:</th>
<th>Credit Scheme:</th>
<th>Examination Scheme:</th>
</tr>
</thead>
</table>
| Theory (TH): 03hrs/week | 03 | Mid_Semester: 30 Marks  
End_Semester: 70 Marks |

**Prerequisite Courses, if any:** Fundamental knowledge of programming language and basics of algorithms

**Companion Course, if any:** Discrete Structures/Discrete Mathematics

**Course Objectives:**
1. To study data structures and their implementations and applications.
2. To learn different searching and sorting techniques.
3. To study some advanced data structures such as trees, graphs and tables.
4. To learn different file organizations.
5. To learn algorithm development and analysis of algorithms.

**Course Outcomes:**
On completion of the course, students will be able to—

**CO1:** Perform basic analysis of algorithms with respect to time and space complexity.

**CO2:** Select appropriate searching and/or sorting techniques in the application development.

**CO3:** Implement abstract data type (ADT) and data structures for given application.

**CO4:** Design algorithms based on techniques like brute-force, divide and conquer, greedy, etc.

**CO5:** Apply implement learned algorithm design techniques and data structures to solve problems.

**CO6:** Design different hashing functions and use files organizations.

### COURSE CONTENTS

<table>
<thead>
<tr>
<th>Unit-I</th>
<th>Introduction</th>
<th>07hrs</th>
</tr>
</thead>
</table>

**Introduction to Data Structures:** Concept of data, Data object, Data structure, Concept of Primitive and non-primitive, linear and Nonlinear, static and dynamic, persistent and ephemeral data structures, Definition of ADT

**Analysis of algorithm:** Frequency count and its importance in analysis of an algorithm, Time complexity & Space complexity of an algorithm Big 'O', 'Ω' and 'Θ' notations,

**Sequential Organization:** Single and multidimensional array and address calculation.

**Linked Organization:** Concept of linked organization, Singly Linked List, Doubly Linked List, Circular Linked List (Operations: Create, Display, Search, Insert, Delete).

<table>
<thead>
<tr>
<th>Case Study</th>
<th>Set Operation, String Operation</th>
</tr>
</thead>
</table>

**Mapping of Course Outcomes for Unit I**  
**CO1, CO3, CO5**

<table>
<thead>
<tr>
<th>Unit-II</th>
<th>Searching and Sorting</th>
<th>06 hrs</th>
</tr>
</thead>
</table>

**Searching and sorting:** Need of searching and sorting, Concept of internal and external sorting, sort stability, Searching methods: Linear and binary search algorithms, Fibonacci Series.

**Sorting methods:** Bubble, insertion, Quick, Merge, shell and comparison of all sorting methods.  
Analyze Insertion sort, Quick Sort, binary search, hashing for Best, Worst and Average case.
### Curriculum for Second Year of Information Technology (2019 Course), Savitribai Phule Pune University

#### Case Study
Study and Analyze Selection sort, bucket sort, radix sort.

#### Mapping of Course Outcomes for Unit II
<table>
<thead>
<tr>
<th>CO1, CO2, CO4, CO5</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Unit III</th>
<th>Stack &amp; Queue</th>
<th>06 hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stack: Concept of stack, Concept of implicit and explicit stack, stack as an ADT using sequential and linked organization, Applications of stack: recursion, converting expressions from infix to postfix or prefix form, evaluating postfix or prefix form.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Queue: Concept of queues as ADT, Implementation of queue using array and linked organization, Concept of circular queue, double ended queue, Applications of queue: priority queue.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Mapping of Course Outcomes for Unit III
<table>
<thead>
<tr>
<th>CO1, CO3, CO4, CO5</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Unit IV</th>
<th>Trees</th>
<th>06 hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tree: Trees and binary trees-concept and terminology, Expression tree, Binary tree as an ADT, Binary search tree, Recursive and Non recursive algorithms for binary tree traversals, Binary search tree as ADT (Insert Search Delete, level wise Display)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Threaded binary tree: Concept of threaded binary tree (inorder, preorder and postorder). Preorder and In-order traversals of in-order threaded binary tree, Applications of trees.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Mapping of Course Outcomes for Unit IV
<table>
<thead>
<tr>
<th>CO1, CO2, CO3, CO5</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Unit V</th>
<th>Graph and Symbol Table</th>
<th>07hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graph - Concept and terminologies, Graph as an ADT, Representation of graphs using adjacency matrix and adjacency list, Breadth First Search traversal, Depth First Search traversal, Prim’s and Kruskal’s algorithms for minimum spanning tree, Shortest path using Dijkstra’s algorithm, topological sorting.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Symbol Table - Notion of Symbol Table, OBST, AVL Trees</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heap: Heap data structure, Min and Max Heap, Heap sort, applications of heap</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Case Study
Consider a network of computers connected to each other. The connection has various parameters associated with it as distance, propagation delay, bandwidth (capacity of carrying data), etc. Based on these parameters, decide which path should be chosen to send data from one computer to every other on the network.

In a system, jobs are submitted for execution at different times. If the system is idle, the job is taken for execution immediately. If there is a job in execution, the newly submitted job is added to a queue. The jobs are assigned a number, which indicates tells the priority of the jobs. The system must execute the high priority jobs first for execution. Implement the above said system using heap data structure.

#### Mapping of Course Outcomes for Unit V
| CO1, CO2, CO3, CO4, CO5 |
**Unit- VI**  | **Hashing and File Organization** | **06 hrs**  
--- | --- | ---  
**Hashing:** Hash tables and scattered tables: Basic concepts, hash function, characteristics of good hash function, Different key-to-address transformations techniques, synonyms or collisions, collision resolution techniques- linear probing, quadratic probing, rehashing, chaining with and without replacement.  
**File:** Concept of File, File types and file organization (sequential, index sequential and Direct Access), Comparison of different file organizations.  
**Case Study** | What are the advantages of binary tree and binary search in file handling? Study Hashing techniques for expandable Files(Extendible, Dynamic and Linear Hashing)  
**Mapping of Course Outcomes for Unit VI** | CO1, CO3, CO5, CO6  
**Text Books:**  
**Reference Books:**  
Savitribai Phule Pune University
Second Year Information Technology (2019 Course)

214444: Object-Oriented Programming

Teaching Scheme:  
Theory (TH): 03hrs/Week
Credit Scheme: 03
Examination Scheme:
Mid_Semester: 30 Marks
End_Semester: 70 Marks

Prerequisites: Principles of Programming Languages

Course Objectives:
1. Apply concepts of object-oriented paradigm.
2. Design and implement models for real life problems by using object-oriented programming.
3. Develop object-oriented programming skills.

Course Outcomes:
On completion of the course, students will be able to—
CO1: Differentiate various programming paradigms.
CO2: Identify classes, objects, methods, and handle object creation, initialization, and
   Destruction to model real-world problems.
CO3: Identify relationship among objects using inheritance and polymorphism principles.
CO4: Handle different types of exceptions and perform generic programming.
CO5: Use of files for persistent data storage for real world application.
CO6: Apply appropriate design patterns to provide object-oriented solutions.

COURSE CONTENTS

Unit I  
Foundations of Object Oriented Programming  |  06 hrs

Introduction OOP: Software Evolution, Introduction to Procedural, Modular, Object-Oriented and
Generic Programming Techniques, Limitations of Procedural Programming, Need of Object-Oriented
Programming, Fundamentals of Object-Oriented Programming: Objects, Classes, Data Members,
Methods, Messages, Data Encapsulation, Data Abstraction and Information Hiding, Inheritance,
Polymorphism, Static and Dynamic Binding, Message Passing.

Case Study  
Model a real world scenario (vehicle class, fruit class, student management in university etc.) using Object Oriented Paradigm

Mapping Course Outcomes for Unit 1

CO1

Unit II  
Classes, Objects and Methods  |  06 hrs

Class: Creating a Class, Visibility/Access Modifiers, Encapsulation, Methods: Adding a Method to Class,
Returning a Value, Adding a Method That Takes Parameters, The ‘this’ Keyword, Method Overloading,
Object Creation, Using Object as a Parameters, Returning Object, Array of Objects, Memory
Declaration, Class as Abstract Data Types (ADTs), Classes as Objects.

Case Study  
Represent a vector using class and include appropriate methods to perform various tasks.
<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit II</th>
<th>CO2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unit III</strong></td>
<td><strong>Constructors and Destructors</strong></td>
</tr>
</tbody>
</table>

**Constructors**: Introduction, Use of Constructor, Characteristics of Constructors, Types of Constructor, Constructor Overloading, Dynamic Initialization of an Object, Constructor with Default Arguments, Symbolic Constants, Garbage Collection: Destructors and Finalizes.

**Case Study**: A book shop inventory

<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit III</th>
<th>CO2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unit IV</strong></td>
<td><strong>Inheritance and Polymorphism</strong></td>
</tr>
</tbody>
</table>

**Inheritance**: Introduction, Need of Inheritance, Types of Inheritance, Benefits of Inheritance, Cost of Inheritance, Constructors in derived Classes, Method Overriding, Abstract Classes and Interfaces. Polymorphism and Software Reuse: Introduction, Types of Polymorphism (Compile Time and Run Time Polymorphism), Mechanisms for Software Reuse, Efficiency and Polymorphism

**Case Study**: A bank account system

<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit IV</th>
<th>CO3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unit V</strong></td>
<td><strong>Exception Handling and Generic Programming</strong></td>
</tr>
</tbody>
</table>

**Exception**: Errors, Types of Errors, Exception and its Types, Exception-Handling Fundamentals, Uncaught Exception, Using try and Catch, Multiple Catch Clauses, Nested Try Statements, User Define Exception using Throw.

**Generics**: What are Generics? Introduction to Language Specific Collection Interface: List Interface and Set Interface, Collection Classes: ArrayList Class and LinkedList Class.

**Case Study**: Exception handling and generic programming using array list (ArrayList class)

<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit V</th>
<th>CO4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unit VI</strong></td>
<td><strong>File Handling and Design Patterns</strong></td>
</tr>
</tbody>
</table>

**File Handling**: Introduction, Concepts of Stream, Stream Classes, Byte Stream Classes, Character Stream, Classes, Using Stream, and Other Useful I/O Classes, Using the File Class, Input/output Exceptions, Creation of Files, Reading/Writing Character, Reading/Writing Bytes, Handling Primitive Data Types, Concatenating and Buffering Files, Random Access Files.

**Design Patterns**: Introduction, Types of Design Patterns, Adapter, Singleton, Iterator

**Case Study**: Student Management System

| Mapping of Course Outcomes for Unit VI | CO5 and CO6 |

**Text Book**: 1. An Introduction to Object Oriented Programming (3rd Ed), by Timothy A. Budd, published by Addison-Wesley, 2002

<table>
<thead>
<tr>
<th>Reference Books</th>
</tr>
</thead>
</table>
## 214445: Basics of Computer Network

### Teaching Scheme:
- **Theory (TH):** 03 hrs/week

### Credit Scheme:
- **03**

### Examination Scheme:
- **Mid Semester:** 30 Marks
- **End Semester:** 70 Marks

### Prerequisite Courses, if any:
Basics of communication

### Course Objectives:
1. To understand the fundamentals of communication system.
2. To understand the basics of internetworking.
3. To understand services and protocols used at Physical, Data Link, Network, Transport Layer.

### Course Outcomes:

On completion of the course, students will be able to—

- **CO1:** Understand and explain the concepts of communication theory and compare functions of OSI and TCP/IP model.
- **CO2:** Analyze data link layer services, error detection and correction, linear block codes, cyclic Codes, framing and flow control protocols.
- **CO3:** Compare different access techniques, channelization and IEEE standards.
- **CO4:** Apply the skills of subnetting, supernetting and routing mechanisms.
- **CO5:** Differentiate IPv4 and IPv6.
- **CO6:** Illustrate services and protocols used at transport layer.

### COURSE CONTENTS

<table>
<thead>
<tr>
<th>Unit I</th>
<th>Data Communication and Network Models</th>
<th>06 hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Introduction to communication Theory</strong></td>
<td>Basics of data communication, Types of Signals, A/D, D/A, A/A, D/D Signal Conversion Methods, Bandwidth Utilization and Data Rate Limits, Multiplexing Techniques, Data rate limits, Topologies, Noise, types of noise, Shannon Hartley Theorem, Channel capacity, Nyquist and Shannon Theorem, Bandwidth S/N trade off.</td>
<td></td>
</tr>
<tr>
<td><strong>Network Models And addressing</strong></td>
<td>OSI Model TCP/IP Model (Data Format, Addressing Mechanisms, Devices)</td>
<td></td>
</tr>
<tr>
<td><strong>Case Study</strong></td>
<td>Study of Physical layer components such as Cable, NIC, hub, etc. available in the computers / laboratories of your department</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit I</th>
<th>CO1</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Unit II</th>
<th>Error Detection, Correction and Data Link Control</th>
<th>06 hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Data Link Layer:</strong></td>
<td>Data Link Layer Services, Error Detection and Correction: Introduction, Error Detection and Error Correction. Linear Block Codes: hamming code, Hamming Distance, parity check code. Cyclic Codes: CRC (Polynomials), Advantages of Cyclic Codes, Other Cyclic Codes (Examples: CHECKSUM: One's Complement, Internet Checksum). Framing: fixed-size framing, variable size framing. Flow control: flow control protocols. Noiseless channels: simplest protocol, stop-and-wait</td>
<td></td>
</tr>
</tbody>
</table>
Noisy channels: stop-and-wait Automatic Repeat Request (ARQ), go-back-n ARQ, Selective repeat ARQ, piggybacking.

Case Study
Draw PPPoE connection diagram with multiple devices, FTTH connection diagram

Mapping of Course Outcomes for Unit II
CO2

Unit III Multi-Access Mechanism and Ethernet Standards 06 hrs


Case Study
Campus network design case study

Mapping of Course Outcomes for Unit III
CO3

Unit IV Network Layer: Services and Addressing 06 hrs


Case Study
Visit server room of campus and understand how IP addressing is done for your respective Campus Institute Department

Mapping of Course Outcomes for Unit IV
CO4, CO5

Unit V Network Layer : Routing Protocols 06 hrs


Case Study
Case study on network simulation tools such as Packet tracer

Mapping of Course Outcomes for Unit V
CO4

Unit VI TRANSPORT LAYER - SERVICES AND PROTOCOLS 06 hrs


Case Study
Case study on Client server model using simple socket programming, Transport Layer Security - Firewall (Stateless Packet...
<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit VI</th>
<th>CO6</th>
</tr>
</thead>
</table>

**Text Books:**


**Reference Books:**

Savitribai Phule Pune University, Pune
Second Year Information Technology (2019 Course)
214446: Logic Design & Computer Organization Lab

Teaching Scheme:  
Credit Scheme: 01
Examination Scheme: PR : 25Marks
TW : 25Marks

Prerequisites: Basic Electronics Engineering

Course Objectives:
1. To design & implement combinational and sequential circuits.
2. To learn simulation of digital systems.

Course Outcomes:
On completion of the course, students will be able to—

CO1: Use logic function representation for simplification with K-Maps and design Combinational logic circuits using SSI & MSI chips.

CO2: Design Sequential Logic circuits: MOD counters using synchronous counters.

CO3: Understand the basics of simulator tool & to simulate basic blocks such as ALU & memory.

Guidelines for Instructor's Manual
The faculty member should prepare the laboratory manual for all the experiments and it should be made available to students and laboratory instructor/assistant. The instructor's manual should include prologue, university syllabus, conduction & Assessment guidelines, topics under consideration concept, objectives, outcomes, algorithms, sample test cases, data sheets of various elements of computer system, ICs, tools and references.

Guidelines for Student's Lab Journal
1. The laboratory assignments are to be submitted by student in the form of journal. The Journal consists of Certificate, table of contents, and handwritten write-up of each assignment. (Title, Objectives, Problem Statement, Outcomes, software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory Concept, circuit diagram, pin configuration, conclusion/analysis, printouts of the output using coding standards, sample test cases etc.)
2. Practical Examination will be based on the term work.
3. The practical examination should be conducted if the teamwork is completed, submitted by the student and is duly assessed, certified by concerned faculty and head of the department.
4. All the assignment mentioned in the syllabus must be conducted.

Guidelines for Lab /TW Assessment
1. Examiners will assess the term work based on performance of students; methodology adopted for implementation of practical assignment, timely submission of assignment in the form of handwritten write-up along with results of implemented assignment, attendance etc.
2. Examiners will judge the understanding of the practical performed in the examination by asking some questions related to theory & implementation of experiments he/she has carried out.
3. Appropriate knowledge of usage of necessary tools software and hardware such as ICs, digital
trainer kits, IC tester& simulation software, should be checked by the faculty member.

### Guidelines for Laboratory Conduction

The instructor is expected to understand the prerequisites, technological aspects, utility and recent trends related to the topic. The instructor may set multiple sets of assignments. It is appreciated if the assignments are based on real world problems/applications. Use of open source software is encouraged.

### Guidelines for Practical Examination

Both internal and external examiners should jointly set problem statements for practical examination. During practical assessment, the expert evaluator should give the maximum weightage to the satisfactory implementation of the problem statement. The supplementary and relevant questions may be asked at the time of evaluation to judge the student’s understanding of the fundamentals, effective and efficient implementation. The evaluation should be done by both external and internal examiners.

### List of Laboratory Assignments

#### Group A

**Combinational Logic Design—CO1**

1. Design and implement 4-bit BCD to Excess-3 code
2. Design and implement 1 digit BCD adder using IC7483
3. Design and implement following using multiplexer IC 74153 1) full adder 2) Any three variable function ( cascade method)
4. Design and implement full subtractor using decoder IC 74138

#### Group B

**Sequential Logic Design—CO2**

1. Design and implement 3 bit Up and 3 bit Down Asynchronous Counters using master slave JK flip-flop IC 7476
2. Design and implement 3 bit Up and 3 bit Down Synchronous Counters using master slave JK flip-flop IC 7476
3. Design and implement Modulo ‘N’ counter using IC7490. ( N= 100 max)

#### Group C

**Computer organization—CO3**

Any two of following, using virtual lab simulator

1. Design & simulate single bit RAM cell OR 4 address*2bit memory using 8 single bit RAM cells.
2. Design & simulate single bit ALU with four functions (AND, OR, XOR, ADD).
3. Design & simulation of single instruction CPU.

Student should submit term work in the form of a journal based on the above assignments.
Note - Instructor should take care that datasheets of all the required ICs are available in the laboratory & students will be able to verify the functionality of ICs being used.

<table>
<thead>
<tr>
<th>Reference Books:</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Virtual Lab simulator Link <a href="http://vlabs.iitkgp.ac.in/coa/">http://vlabs.iitkgp.ac.in/coa/</a></td>
</tr>
</tbody>
</table>
### 214447: Data Structure & Algorithms Lab

**Teaching Scheme:**

<table>
<thead>
<tr>
<th>Practical (PR)</th>
<th>Credit Scheme</th>
<th>Examination Scheme</th>
</tr>
</thead>
<tbody>
<tr>
<td>04 hrs/week</td>
<td>02</td>
<td>PR: 25 Marks</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TW: 25 Marks</td>
</tr>
</tbody>
</table>

**Prerequisite Courses, if any:** Fundamental knowledge of programming language and basics of algorithms

**Course Objectives:**

1. To study data structures and their implementations and applications.
2. To learn different searching and sorting techniques.
3. To study some advanced data structures such as trees, graphs and tables.
4. To learn different file organizations.
5. To learn algorithm development and analysis of algorithms.

**Course Outcomes:**

On completion of the course, students will be able to—

- **CO1:** Analyze algorithms and to determine algorithm correctness and time efficiency class.
- **CO2:** Implement abstract data type (ADT) and data structures for given application.
- **CO3:** Design algorithms based on techniques like brute-force, divide and conquer, greedy, etc.).
- **CO4:** Solve problems using algorithmic design techniques and data structures.
- **CO5:** Analyze of algorithms with respect to time and space complexity.

**Guidelines for Instructor’s Manual**

The faculty member should prepare the laboratory manual for all the experiments and it should be made available to students and laboratory instructor/Assistant.

The instructor’s manual should include prologue, university syllabus, conduction & Assessment guidelines, topics under consideration-concept, objectives, outcomes, algorithm written in pseudo language, sample test cases and references. Experiments to be conducted in C++.

**Guidelines for Student’s Lab Journal**

1. The laboratory assignments are to be submitted by students in the form of journals. The Journal consists of prologue, Certificate, table of contents, and handwritten write-up of each assignment (Title, Objectives, Problem Statement, Outcomes, software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory-Concept, algorithms, printouts of the code written using coding standards, sample test cases etc.)
2. Practical Examination will be based on the term work.
3. Candidate is expected to know the theory involved in the experiment.
4. The practical examination should be conducted if the journal of the candidate is completed in all respects and certified by concerned faculty and head of the department.
Guidelines for Lab /TW Assessment

1. Examiners will assess the term work based on performance of students considering the parameters such as timely conduction of practical assignment, methodology adopted for implementation of practical assignment, timely submission of assignment in the form of handwritten write-up along with results of implemented assignment, attendance etc.
2. Examiners will judge the understanding of the practical performed in the examination by asking some questions related to theory & implementation of experiments he/she has carried out.
3. Appropriate knowledge of usage of software and hardware such as compiler, debugger, coding standards, algorithm to be implemented etc. should be checked by the concerned faculty member(s).

Guidelines for Laboratory Conduction

The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The instructor may set multiple sets of assignments and distribute among batches of students. It is appreciated if the assignments are based on real world problems/applications.

All the assignments should be conducted on multicore hardware and 64-bit open-source software.

Guidelines for Practical Examination

Both internal and external examiners should jointly set problem statements for practical examination. During practical assessment, the expert evaluator should give the maximum weightage to the satisfactory implementation of the problem statement. The supplementary and relevant questions may be asked at the time of evaluation to judge the student’s understanding of the fundamentals, effective and efficient implementation. The evaluation should be done by both external and internal examiners.

List of Assignments

Virtual Laboratory

- [https://ds1-iiith.vlabs.ac.in/data-structures-1/](https://ds1-iiith.vlabs.ac.in/data-structures-1/)
- [https://ds2-iiith.vlabs.ac.in/data-structures-2/](https://ds2-iiith.vlabs.ac.in/data-structures-2/)
- [http://cse01-iiith.vlabs.ac.in/](http://cse01-iiith.vlabs.ac.in/)

1. Searching and Sorting -- CO1, CO2, CO3, CO5

Consider a student database of SEIT class (at least 15 records). Database contains different fields of every student like Roll No, Name and SGPA. (array of structure)

a) Design a roll call list, arrange list of students according to roll numbers in ascending order (Use Bubble Sort)
b) Arrange list of students alphabetically. (Use Insertion sort)
c) Arrange list of students to find out first ten toppers from a class. (Use Quick sort)
d) Search students according to SGPA. If more than one student having same SGPA, then print list of all students having same SGPA.
e) Search a particular student according to name using binary search without recursion. (all the
### 2. Stack -- CO1, CO2, CO3, CO5

Implement stack as an abstract data type using singly linked list and use this ADT for conversion of infix expression to postfix, prefix and evaluation of postfix and prefix expression.

### 3. Circular Queue -- CO1, CO2, CO3, CO5

Implement Circular Queue using Array. Perform following operations on it.
- **a)** Insertion (Enqueue)
- **b)** Deletion (Dequeue)
- **c)** Display

(Note: Handle queue full condition by considering a fixed size of a queue.)

### 4. Expression Tree -- CO1, CO2, CO3, CO5

Construct an Expression Tree from postfix and prefix expression. Perform recursive and non-recursive In-order, Pre-order and Post-order traversals.

### 5. Binary Search Tree -- CO1, CO2, CO3, CO5

Implement binary search tree and perform following operations:
- **a)** Insert (Handle insertion of duplicate entry)
- **b)** Delete
- **c)** Search
- **d)** Display tree (Traversal)
- **e)** Display - Depth of tree
- **f)** Display - Mirror image
- **g)** Create a copy
- **h)** Display all parent nodes with their child nodes
- **i)** Display leaf nodes
- **j)** Display tree level wise

(Note: Insertion, Deletion, Search and Traversal are compulsory, from rest of operations, perform Any three)

### 6. Threaded Binary Tree -- CO1, CO2, CO3, CO5

Implement In-order Threaded Binary Tree and traverse it in In-order and Pre-order.

### 7. Graph: Minimum Spanning Tree -- CO1, CO2, CO3, CO5

Represent a graph of your college campus using adjacency list /adjacency matrix. Nodes should represent the various departments/institutes and links should represent the distance between them. Find minimum spanning tree
- **a)** Using Kruskal’s algorithm.
- **b)** Using Prim’s algorithm.

### 8. Graph: Shortest Path Algorithm -- CO1, CO2, CO3, CO5

Represent a graph of city using adjacency matrix /adjacency list. Nodes should represent the various...
landmarks and links should represent the distance between them. Find the shortest path using Dijkstra's algorithm from single source to all destination.

<table>
<thead>
<tr>
<th>9. Heap Sort -- CO1, CO2, CO4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Implement Heap sort to sort given set of values using max or min heap.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>10. FILE Handling -- CO1, CO3, CO5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Department maintains student's database. The file contains roll number, name, division and address. Write a program to create a sequential file to store and maintain student data. It should allow the user to add, delete information of student. Display information of particular student. If record of student does not exist an appropriate message is displayed. If student record is found it should display the student details.</td>
</tr>
</tbody>
</table>

### Text Books:


### Reference Books

Savitribai Phule Pune University, Pune
Second Year Information Technology (2019 Course)
214448: Object Oriented Programming Lab

Teaching Scheme:
<table>
<thead>
<tr>
<th>Credit Scheme:</th>
<th>Examination Scheme:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practical (PR) : 04 hrs/week</td>
<td>02</td>
</tr>
<tr>
<td>PR: 25 Marks</td>
<td>TW: 25 Marks</td>
</tr>
</tbody>
</table>

Prerequisites: Student should have knowledge of programming language.

Course Objectives:
1. Apply concepts of object-oriented paradigm.
2. Design and implement models for real life problems by using object-oriented programming.
3. Develop object-oriented programming skills.

Course Outcomes:
On completion of the course, students will be able to–
CO1: Differentiate various programming paradigms.
CO2: Identify classes, objects, methods, and handle object creation, initialization, and destruction to model real-world problems.
CO3: Identify relationship among objects using inheritance and polymorphism.
CO4: Handle different types of exceptions and perform generic programming.
CO5: Use file handling for real world application.
CO6: Apply appropriate design patterns to provide object-oriented solutions.

Guidelines for Instructor's Manual
The instructor’s manual is to be developed as a hands-on resource and reference. The instructor’s manual need to include prologue (about University/program/institute/department/foreword/preface etc.), University syllabus, conduction & Assessment guidelines, topics under consideration concept, objectives, outcomes, set of typical applications/assignments/guidelines, and references.

Guidelines for Student's Lab Journal
1. The laboratory assignments are to be submitted by student in the form of journal.
2. Journal consists of prologue, Certificate, table of contents, and handwritten write-up of each assignment (Title, Objectives, Problem Statement, Outcomes, software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor’s sign, Theory- OOP feature/Concept in brief, algorithm, flowchart, test cases, conclusion/analysis.
3. Program codes with sample output of all performed assignments are to be submitted as hardcopy.
4. As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journal may be avoided.
5. Use of DVD containing students programs maintained by lab In-charge is highly encouraged.
6. For reference one or two journals may be maintained with program prints at Laboratory.

Guidelines for Lab /TW Assessment
1. Continuous assessment of laboratory work is done based on overall performance and lab
Curriculum for Second Year of Information Technology (2019 Course), Savitribai Phule Pune University

assignments performance of student.
2. Each lab assignment assessment will assign grade/marks based on parameters with appropriate weightage.
3. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness.

Guidelines for Practical Examination

Both internal and external examiners should jointly set problem statements. During practical assessment, the expert evaluator should give the maximum weightage to the satisfactory implementation of the problem statement. The supplementary and relevant questions may be asked at the time of evaluation to test the student’s for advanced learning, understanding of the fundamentals, effective and efficient implementation. So encouraging efforts, transparent evaluation and fair approach of the evaluator will not create any uncertainty or doubt in the minds of the students.

Guidelines for Laboratory Conduction

The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The assignment framing policy need to address the average students and inclusive of an element to attract and promote the intelligent students. The instructor may set multiple sets of assignments without changing its complexity level and distribute among batches of students. Encourage students for the use of industry coding standards such as appropriate use of Hungarian notation, Indentation and comments. Use of open source software is encouraged. Set of suggested assignment list is provided, instructors may take different case studies with similar complexity level. Operating System recommended :- 64-bit Open source Linux or its derivative
Programming tools recommended: - JAVA IDE

List of Assignments

1. Classes and object -- CO1 and CO2

Design a class ‘Complex ‘with data members for real and imaginary part. Provide default and Parameterized constructors. Write a program to perform arithmetic operations of two complex numbers.

2. Polymorphism -- CO3

Identify commonalities and differences between Publication, Book and Magazine classes. Title, Price, Copies are common instance variables and saleCopy is common method. The differences are, Bookclass has author and orderCopies(). Magazine Class has methods orderQty, Current issue, receiveissue().Write a program to find how many copies of the given books are ordered and display total sale of publication.

3. Inheritance -- CO3

Design and develop inheritance for a given case study, identify objects and relationships and implement inheritance wherever applicable. Employee class hasEmp_name, Emp_id, Address,
Mail_id, and Mobile_no as members. Inherit the classes: Programmer, Team Lead, Assistant Project Manager and Project Manager from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10% of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club fund. Generate pay slips for the employees with their gross and net salary.

4. Dynamic Binding -- CO3

Design a base class shape with two double type values and member functions to input the data and compute_area() for calculating area of shape. Derive two classes: triangle and rectangle. Make compute_area() as abstract function and redefine this function in the derived class to suit their requirements. Write a program that accepts dimensions of triangle/rectangle and display calculated area. Implement dynamic binding for given case study.

5. Interface -- CO1, CO3

Design and develop a context for given case study and implement an interface for Vehicles. Consider the example of vehicles like bicycle, car and bike. All Vehicles have common functionalities such as Gear Change, Speed up and apply breaks. Make an interface and put all these common functionalities. Bicycle, Bike, Car classes should be implemented for all these functionalities in their own class in their own way.

6. Exception handling -- CO4

Implement a program to handle Arithmetic exception, Array Index Out of Bounds. The user enters two numbers Num1 and Num2. The division of Num1 and Num2 is displayed. If Num1 and Num2 are not integers, the program would throw a Number Format Exception. If Num2 were zero, the program would throw an Arithmetic Exception. Display the exception.

7. Template -- CO4

Implement a generic program using any collection class to count the number of elements in a collection that have a specific property such as even numbers, odd number, prime number and palindromes.

8. File Handling -- CO5

Implement a program for maintaining a database of student records using Files. Student has Student_id, name, Roll_no, Class, marks and address. Display the data for few students.

1. Create Database
2. Display Database
3. Delete Records
4. Update Record
5. Search Record

9. Case Study -- CO2, CO5

Using concepts of Object-Oriented programming develop solution for any one application:

1) Banking system having following operations:
1. Create an account
2. Deposit money
3. Withdraw money
4. Honor daily withdrawal limit
5. Check the balance

2) Inventory management system having following operations:
   1. List of all products
   2. Display individual product information
   3. Purchase
   4. Shipping
   5. Balance stock

10. Factory Design Pattern -- CO6

Implement Factory design pattern for the given context. Consider Car building process, which requires many steps from allocating accessories to final makeup. These steps should be written as methods and should be called while creating an instance of a specific car type. Hatchback, Sedan, SUV could be the subclasses of Car class. Car class and its subclasses, CarFactory and Test Factory Pattern should be implemented.

11. Strategy Design Pattern -- CO6

Implement and apply Strategy Design pattern for simple Shopping Cart where three payment strategies are used such as Credit Card, PayPal, Bit Coin. Create an interface for strategy pattern and give concrete implementation for payment.

Text Books:


Reference Books:

2. Bruce Eckel, “Thinking in Java”, PHI Publication
5. Rohit Joshi, “Java Design patterns, Reusable solutions to common problems” Java Code Geeks
Savitribai Phule Pune University  
Second Year Information Technology (2019 Course)

214449: Soft Skill Lab

<table>
<thead>
<tr>
<th>Teaching Scheme:</th>
<th>Credit Scheme:</th>
<th>Examination Scheme:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practical (PR): 02 hrs/Week</td>
<td>01</td>
<td>TW : 25 Marks</td>
</tr>
</tbody>
</table>

Prerequisites, if any: ------

Course Objectives:

1. To facilitate a holistic development of students while focusing on enhancing soft skills.
2. To highlight the need to improve soft skills among engineering students so as to become good professionals.
3. To develop and nurture the soft skills of the students through individual and group activities.
4. To expose students to right attitudinal and behavioural aspects and assist in building the same through activities.

Course Outcomes:

On completion of the course, students will be able to—

**CO1:** Introspect about individual’s goals, aspirations by evaluating one’s SWOC and think creatively.

**CO2:** Develop effective communication skills including Listening, Reading, Writing and Speaking.

**CO3:** Constructively participate in group discussion, meetings and prepare and deliver Presentations.

**CO4:** Write precise briefs or reports and technical documents.

**CO5:** Practice professional etiquette, present oneself confidently and successfully handle personal interviews.

**CO6:** Function effectively in multi-disciplinary and heterogeneous teams through the knowledge of team work, Inter-personal relationships, conflict management and leadership quality.

COURSE CONTENTS

<table>
<thead>
<tr>
<th>Unit</th>
<th>Introspective &amp; Self Development</th>
<th>04 hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit I</td>
<td>Introduction to soft skills, SWOC analysis, planning career, setting short-term &amp; long-term goals, identifying difference between jobs &amp; career, aligning aspirations with individual skills, understanding self-esteem, developing discipline and critically evaluating oneself</td>
<td></td>
</tr>
</tbody>
</table>

Mapping of Course Outcomes for Unit I: CO1, CO6

<table>
<thead>
<tr>
<th>Unit II</th>
<th>Communication Skills</th>
<th>04 hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit II</td>
<td>Essentiality of good communication skills, importance of feedback, different types of communication, barriers in communication and how to overcome these barriers, significance of non-verbal messages as augmentation to verbal communication, group discussion, listening vs hearing, reading to comprehend, learning to skim and scan to extract relevant information, effective digital communication</td>
<td></td>
</tr>
</tbody>
</table>

Mapping of Course Outcomes for Unit II: CO2, CO3, CO5
## Unit III
### Language and Writing Skills
- **04 hrs**

Fundamentals of english grammar, improve lexical resource, essential steps to improve spoken and written english, business vocabulary, writing – email, resume, formal letter, official communication, essay, presentation – planning, organizing, preparing and delivering professional presentation.

<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit III</th>
<th>CO2, CO4</th>
</tr>
</thead>
</table>

### Unit IV
### Leadership Skills and Group Dynamics
- **04 hrs**

Understanding corporate culture and leadership skills, difference between a leader and a manager, importance of resilience in a professional surrounding, developing empathy and emotional intelligence, being assertive and confident, 4-Ds of decision making, creative and solution-centric thinking, resolving conflicts, working cohesively as a team to achieve success, five qualities of an effective team – positivity, respect for others, trust, goal-focused, supportiveness.

<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit IV</th>
<th>CO1, CO5, CO6</th>
</tr>
</thead>
</table>

### Unit V
### Ethics, Professional Etiquette
- **04 hrs**

Understanding ethics and morals, importance of professional ethics, hindrances due to absence of work ethics, professional etiquette – introductions, with colleagues, attire, events, dinning, telephone, travelling, netiquette, social media, writing.

<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit V</th>
<th>CO5, CO6</th>
</tr>
</thead>
</table>

### Unit VI
### Stress And Time Management
- **04 hrs**

Stress as integral part of life, identifying signs and sources of stress, steps to cope with stress – open communication, positive thinking, belief in oneself, ability to handle failure, retrospective thinking for future learning, organizing skills to enhance time management, focusing on goals, smart work vs hard work, prioritizing activities, perils of procrastination, daily evaluation of “to-do” list.

<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit VI</th>
<th>CO1, CO3, CO6</th>
</tr>
</thead>
</table>

### Text Book:

### Reference Books:
Guidelines for Student’s Lab Journal and TW Assessment

Each student should have a Lab Workbook (sample workbook attached) which outlines each lab activity conducted. The student must respond by writing out their learning outcomes and elaborating the activities performed in the lab. Continuous assessment of laboratory work is to be done based on overall performance and lab assignments and performance of student. Each lab assignment assessment will be assigned grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, punctuality, neatness, enthusiasm, participation and contribution in various activities-SWOC analysis, presentations, team activity, event management, group discussion, group exercises and interpersonal skills and similar other activities/assignments.

Guidelines for Conduction of Soft Skills Lab

The teacher may design specific assignments that can highlight the learning outcomes of each unit. Each activity conducted in the lab should begin with a brief introduction of the topic, purpose of the activity from a professional point of view and end with the learning outcomes as feedback from students. Most of the lab sessions can be designed to be inclusive; allowing students to learn skills experientially; which will benefit them in the professional environment. Every student must be given sufficient opportunity to participate in each activity and constructive feedback from the instructor/facilitator at the end of the activity should learn towards encouraging students to work on improving their skills. Activities should be designed to respect cultural, emotional and social standing of students. Some of the activities can be designed to cater to enhancement of multiple skills — For e.g. — Team Building Activity can highlight ‘open communication’, ‘group discussion’, ‘respecting perspectives’, ‘leadership skills’, ‘focus on goals’ which can help students improve their inherent interpersonal skills.

At least one session should be dedicated to an interactive session that will be delivered by an expert from the industry; giving the students an exposure to professional expectations.

Virtual Laboratory

- [https://ve-iitg.vlabs.ac.in/](https://ve-iitg.vlabs.ac.in/)

Recommended List of Lab Sessions

<table>
<thead>
<tr>
<th>1. Introduction of Self / SWOC Analysis -- CO1, CO4</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Explain how to introduce oneself in a professional manner and presenting oneself positively Name, Academic Profile, Achievements, Career Aspirations, Personal Information (hobbies, family, social).</td>
</tr>
<tr>
<td>b. Focus on introspection and become aware of one’s Strengths, Weakness, Opportunities and Challenges. Students can write down their SWOC in a matrix and the teacher can discuss the gist personally.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Career Goals and Planning -- CO1, CO4</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Make students understand the difference between a job and a career. Elaborate steps on how to plan a career. Students can choose a career and they should write down what skills, knowledge, steps are needed.</td>
</tr>
</tbody>
</table>
to be successful in that particular career and how they can get the right opportunity.

b. Explain to students how to plan short term and long term goals. Think and write down their short-term goals and long terms goals. Teacher can read and discuss (provide basic counselling) about the choices written.

### 3. Public Speaking -- (Choose any 2) -- CO3, CO2

- **a. Prepared Speech**
  Topics will be shared with students and they will be given 10 minutes to prepare and 3 minutes to deliver followed by Q&A from audience. Teacher will evaluate each student based on content, communication skills, logical and cohesive presentation of topic, perspective of student, ability to handle questions and respond positively.

- **b. Extempore Speech**
  Various topics will be laid out in front of the audience and each student is to pick one topic and speak about the topic for 5 minutes followed by Q&A from audience. Teacher will evaluate each student based on ability to think on his/her feet, content, communication skills, logical and cohesive presentation of topic, perspective of student, ability to handle questions and respond positively.

- **c. Reviewing an Editorial article**
  Either using e-paper / printed copy, students have to select a recent editorial (that is non-controversial), read it and explain to the audience what the editor’s perspective is and what the student’s perspective is.

- **d. Book Review**
  Each student will orally present to the audience his/her review of a book that he/she has recently read.

### 4. Group Discussion -- CO3, CO2

- **a.** The class will be divided into groups of 8 – 10 students in for a discussion lasting 10 minutes.
- **b.** Topics should be topical and non-controversial. After each group finishes its discussion, the teacher will give critical feedback including areas of improvement. The teacher should act as a moderator / observer only.

### 5. Listening and Reading Skills -- CO2

- **a.** Listening Worksheets to be distributed among students
  Each student will be given specifically designed worksheets that contain blanks / matching / MCQs that are designed to an audio (chosen by the faculty). Students have to listen to the audio (only once) and complete the worksheet as the audio plays. This will help reiterate active listening as well as deriving information (listening to information between the lines).

- **b.** Reading Comprehension Worksheets to be distributed/displayed to students
  Teacher will choose reading passages from non-technical domains, design worksheets with questions for students to answer. This will enhance student’s reading skills by learning how to skim and scan for information.

### 6. Writing Skills (Choose any 2) -- CO2

- **a.** Letter / Email Writing
  After explaining to the students the highlights of effective writing, students can be asked to write (using digital platforms / paper-based) letter to an organization with the following subject matter,
  i. Requesting opportunity to present his/her product.
  ii. Complaining about a faulty product / service.
iii. Apologizing on behalf of one’s team for the error that occurred.
iv. Providing explanation for a false accusation by a client.

b. Report Writing
   After describing various formats to write report and explaining how to write a report, each student should be asked to write a report (digital/paper-based) on any of the following topics,
   i. Industrial visit.
   ii. Project participated in.

c. Resume Writing
   The teacher should conduct a brief session outlining the importance of a CV/Resume and students can write/type out their own resumes
   i. Share various professional formats.
   ii. Focus on highlighting individual strengths.
   iii. Develop personalized professional goals/statement at the beginning of the resume.

7. Team Building Activities -- CO3, CO4
The class will be divided into groups of 4-5 students in each group and an activity will be given to each group.
The activities chosen for each team should be competitive and should involve every student in the team. The activities may be conducted indoors or outdoors depending on infrastructure. While selecting the team, ensure that each team has a mix of students who have varied skills. The teacher should give critical feedback including areas of improvement at the end of the activity.

8. Expert Lecture -- CO4
Highlighting the need to manage stress and time, experts from the fields of health and fitness, counselling, training, medical or corporate HR may be invited to deliver a participatory session that focus on helping students to cope with parental, social, peer and career pressures.

9. Lateral and Creative Thinking -- CO1, CO4
Every student needs to step out of the linear thinking and develop lateral and creative thinking. Teacher can develop creative activities in the classroom/lab that will help students enhance their creative thinking. Some of the suggested activities,
   i. Each group (3-4 students) can be given random unrelated items and they will be given sufficient time to come up with creative ideas on how the objects can be used for activities/purposes other than its intended one.
   ii. Each student is given a random line and he/she has to spin a fictional story and tell it to the class (3 minutes). Each story should have a beginning, middle and end.
   iii. Each group (3-4 students) can be given a fictional/hypothetical dangerous situation and they have to find a solution to that problem. They can present it to the other teams who will then get the opportunity to pick flaws in the ideas.

10. Mock Interviews -- CO2, CO3
Student has to undergo interview session and the teacher should seek the assistance of another faculty member/TPO Officer/Alumni to act as interview panel. Students will be informed beforehand about the job profile that they are appearing the interview for and they have to come prepared with a printed copy of their resume, formally dressed. Questions will include technical as well as HR. Interviewer can choose to give problems to solve using technical skills. Students will be graded on the basis of their technical knowledge, ability to answer questions well, presentation of self, body language and verbal skills.
### 11. Presentation Skills -- CO2, CO3

Every student will have to choose a topic of his/her choice and make a 5-minute presentation using audio-video aids / PPT. The topic can either be technical or non-technical. Focus and evaluation of each presentation should be the depth of knowledge about the topic, originality of perspective on the topic, well-researched or not, verbal and non-verbal skills and ability to answer questions effectively. Plagiarism should be discredit and students should be instructed about it.

### 12. Corporate and Business Etiquette -- CO4, CO1

The teacher can design an interactive session that allows students to be involved in understanding the requirements of a corporate environment. This can be done using innovative quiz competition in the classroom and the teacher explaining the concept / relevance of that particular aspect in the professional context. Alternatively, the teacher can invite professionals to have an interactive session with students about various aspects of professional etiquette.
## Savitribai Phule Pune University, Pune

### Second Year Information Technology (2019 Course)

**214450 (A): Mandatory Audit Course 3:**

**Ethics and Values in Information Technology**

<table>
<thead>
<tr>
<th>Teaching Scheme:</th>
<th>Credit Scheme:</th>
<th>Examination Scheme:</th>
</tr>
</thead>
<tbody>
<tr>
<td>01hrs/week</td>
<td>Non Credit</td>
<td>Audit Course</td>
</tr>
</tbody>
</table>

**Prerequisite Courses, if any:** --

### Course Objectives:

1. To understand and implement the values and principles in the field of Information Technology.
2. To nurture honest and responsible professionals in Information Technology.
3. To develop student’s understanding about social/professional ethical issues related to Information Technology.
4. To inculcate professional ethics in the field of IT.

### Course Outcomes:

On completion of this course students will be able to:

- **CO1:** Adapt the global ethical principles and modern ethical issues.
- **CO2:** Apprehend ethics in the business relationships and practices of IT.
- **CO3:** Implement trustworthy computing to manage risk and security vulnerabilities.
- **CO4:** Analyse concerns of privacy, privacy rights in information-gathering practices in IT.

### COURSE CONTENTS

#### An overview of Ethics

- **An overview of Ethics:** Brief about ethics, Ethics in the Business World, Ethics in IT.

- **Ethics for IT professionals and IT users:** IT professionals: Changing Professional Services, Professional Relationships, Codes of Ethics, awareness of IT malpractices, IT Users: Common Ethical Issues for IT Users, Supporting the Ethical Practices of IT Users.

<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit I</th>
<th>CO1, CO2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unit - I</strong></td>
<td>An Overview of Ethics</td>
</tr>
</tbody>
</table>

**Introduction:** IT security incidents, Types of Exploits, Types of Perpetrators, Laws for Prosecuting Computer Attacks, Implementing Trustworthy Computing, Risk and Vulnerability Assessment, Educating Employees, Contractors, and Part-Time Workers, Establishing a Security Policy

**Privacy:** The right of Privacy, Privacy Protection and the Law, Key Privacy and Anonymity Issues, Identity Theft, Consumer Profiling, Treating Consumer Data Responsibility, Workplace Monitoring

**Freedom of Expression:** Defamation and Hate Speech, Key issues, Controlling Access to Information on the Internet, Anonymity on the Internet, Corporate Blogging, Pornography

<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit II</th>
<th>CO3, CO4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unit - II</strong></td>
<td>Computer And Internet Crime</td>
</tr>
</tbody>
</table>
## Unit- III

### Social Networking & Ethics of IT Organization

| **Social Networking:** Brief about Social Networking, **Social Networking Ethical Issues:** Cyber bullying, Cyber stalking, Encounters with Sexual Predators, Uploading of Inappropriate Material,

**Online Virtual Worlds:** Crime in Virtual Worlds, Educational and Business Uses of Virtual Worlds.

**Ethics of IT Organization:** Key Ethical Issues for Organizations, of Workers, Outsourcing, Whistle-blowing, Code of Ethics and Professional Conduct.

| Mapping of Course Outcomes for Unit III | CO2, CO3, CO4 |

| **Unit - IV** | **Case Study** | **03hrs** |

**Malware, Medical Implants, Abusive Workplace Behaviour, Automated Active Response Weaponry, Malicious Inputs to Content Filters.**

| Mapping of Course Outcomes for Unit IV | CO1, CO2, CO3, CO4 |

### Text Books:


### Reference Books:

   [https://www.acm.org/code-of-ethics/case-studies](https://www.acm.org/code-of-ethics/case-studies)

### Evaluation:

Students should select any one of the topic in a group of 3 to 5. Students should submit a written report and make a presentation on the topic. The task should not be repeated among students. Report will be evaluated by the faculty as per rubrics defined by him/her/them at start of course.
214450 (B) : Mandatory Audit Course 3:  
Quantitative Aptitude & Logical Reasoning

Course Objectives:
1. To develop the quantitative, logical and verbal abilities.
2. To enable learners to interpret the data accurately.
3. To build logical thinking ability among the learners.
4. To enable students to comprehend the English text.

Course Outcomes:
On completion of the course, learner will be able to ---

CO1: Apply basic concepts of quantitative abilities
CO2: Use logical reasoning for solving real world problems
CO3: Compete in examinations like internships, industry placements, postgraduate admissions, civil services etc.

COURSE CONTENTS

<table>
<thead>
<tr>
<th>Unit I</th>
<th>Fundamental Quantitative Abilities</th>
<th>03 hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concepts and Problems on Number System, HCF and LCM, Average, Ratio and Proportion, Percentage, Year month days counting, SI units and measurements</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit I</th>
<th>CO1, CO2, CO3</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Unit II</th>
<th>Arithmetic Quantitative Abilities</th>
<th>02 hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concepts and Problems on Ages, Profit and loss, Simple and Compound interest, Time value of money, Time and distance, Time and Work, Geometry and Coordinate Geometry, logarithms</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit II</th>
<th>CO1, CO2, CO3</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Unit III</th>
<th>Logical Reasoning Ability</th>
<th>02 hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number Series, Pattern recognition, Alpha Numerical, Letter &amp; Symbol Series , Numerical and Alphabet Puzzles, Seating Arrangement</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit III</th>
<th>CO2, CO3</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Unit IV</th>
<th>Thinking and Reasoning</th>
<th>02 hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objective Reasoning, Graph and Plots, Data sufficiency, Blood Relation, Coding deductive logic, Logical word sequence</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Mapping of Course Outcomes for Unit IV

<table>
<thead>
<tr>
<th>CO2, CO3</th>
</tr>
</thead>
</table>

#### Unit V

<table>
<thead>
<tr>
<th>Verbal Ability</th>
<th>03 hrs</th>
</tr>
</thead>
</table>

Synonyms, Antonyms, Contextual Vocabulary, Error Identification, Sentence Correction, Sentence Improvement, Subject-Verb agreement, Tenses and Articles, Reading Comprehension, Preposition & Conjunction

### Mapping of Course Outcomes for Unit V

<table>
<thead>
<tr>
<th>CO1, CO2, CO3</th>
</tr>
</thead>
</table>

#### Text Books:

1. Quantitative abilities by Arun Sharma, Motilal Uk Books Of India, 2012
2. Quantitative Aptitude for Competitive Examinations by R S Agrawal
3. Verbal and Non-Verbal reasoning by R S Agrawal

#### Evaluation:

Students should select any one of the topic in a group of 3 to 5. Students should submit a written report and make a presentation on the topic. The task should not be repeated among students. Report will be evaluated by the faculty as per rubrics defined by him/her/them at start of course.
## 214450 (C): Mandatory Audit Course 3: Language Study Japanese - Module I

<table>
<thead>
<tr>
<th>Teaching Scheme:</th>
<th>Credit Scheme:</th>
<th>Examination Scheme:</th>
</tr>
</thead>
<tbody>
<tr>
<td>01hrs/week</td>
<td>Non Credit</td>
<td>Audit Course</td>
</tr>
</tbody>
</table>

### Prerequisite Courses, if any:
Audit Course 4: Language Study Japanese: Module-II

### Course Objectives:
1. To teach pronunciation and intonation of Japanese sounds.
2. To enable students to comprehend and speak simple sentences in Japanese.
3. To introduce Japanese language at the basic level, to enable students to read and write the phonetic scripts, *Hiragana* and *Katakana*, and approx. 100 *Kanji*.
4. To teach some aspects of Japanese society and culture.

### Course Outcomes:
On completion of the course, learner will be able to --
- **CO1**: Converse with simple sentences in Japanese.
- **CO2**: Recognize and read simple sentences in Japanese.
- **CO3**: Write simple sentences in Japanese.
- **CO4**: Be aware about Japanese society and people.

### Course Contents

#### Unit I: Japanese Oral Expression (02 hrs + 04 hrs Self Study)
Oral practice of pronunciation and intonation of Japanese sounds, Japanese greetings, self-introduction, identifying things, time of the day, calendar; counting using Japanese numerical classifiers; describing things; making comparisons; talking of daily activities; kinship terms used for address and reference; seasons; giving and receiving, shopping; making requests, talking of one’s likes and dislikes.

#### Mapping of Course Outcomes for Unit I

<table>
<thead>
<tr>
<th>CO1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unit II</strong>: Japanese Kana and Kanji (02 hrs + 04 hrs Self Study)</td>
</tr>
</tbody>
</table>

Introduction of the Japanese writing system, i.e. *Hiragana*, *Katakana* and *Kanji* (100-120), word-building, writing foreign names and loan words in Katakana.

#### Mapping of Course Outcomes for Unit II

<table>
<thead>
<tr>
<th>CO2, CO3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unit III</strong>: JapaneseGreetings (02 hrs + 04 hrs Self Study)</td>
</tr>
</tbody>
</table>

Basic sentence patterns to be applied in self-introduction, identifying things; time of the day; calendar; counting using Japanese numerical classifiers; describing things; making comparisons; talking of daily activities; kinship terms used for address and reference; seasons; giving and receiving; shopping; making requests, talking of one’s likes and dislikes.
### Mapping of Course Outcomes for Unit III

<table>
<thead>
<tr>
<th>CO1</th>
<th>Japanese Comprehension</th>
<th>(02 hrs + 04 hrs Self Study)</th>
</tr>
</thead>
</table>

Extensive practice of basic patterns at the elementary level through drills and exercises.

### Mapping of Course Outcomes for Unit IV

<table>
<thead>
<tr>
<th>CO1, CO2</th>
<th>Japanese Comprehension</th>
<th>(02 hrs + 4 hrs Self Study)</th>
</tr>
</thead>
</table>

### Mapping of Course Outcomes for Unit V

<table>
<thead>
<tr>
<th>CO1</th>
<th>Speaking Japanese</th>
<th>(02 hrs + 4 hrs Self Study)</th>
</tr>
</thead>
</table>

Simple conversation in situations such as describing things, making comparisons, talking of daily activities, giving and receiving of gifts, talking of illnesses and visit to a doctor, shopping, making requests, talking of one’s likes and dislikes, talking on telephone etc.

### Mapping of Course Outcomes for Unit VI

<table>
<thead>
<tr>
<th>CO4</th>
<th>Social Environment of Japan</th>
<th>(02 hrs + 4 hrs Self Study)</th>
</tr>
</thead>
</table>

An introduction to some aspects of Japanese culture such as festivals, Japanese seasons, Japanese people and their love for nature; Japanese food, sports; society; geography; education system; Japan and the world etc. The objective is to create general awareness in students about life in Japan.

### E-Resources for Learning Support:

2. [https://www.freejapanesellessons.com/](https://www.freejapanesellessons.com/)
3. [https://minato-jf.jp/](https://minato-jf.jp/) (Japan Foundation)

### Text Books:


### Reference Books:

2. Yukiko Ogata, Kana Sumitani, Yasuko Hidari, Yukiko Watanabe, Nihongo fun and Easy -I Survival Japanese Conversation for Beginners,

### Evaluation:

Students should select any one of the topic in a group of 3 to 5. Students should submit a written report and make a presentation on the topic. The task should not be repeated among students. Report will be evaluated by the faculty as per rubrics defined by him/her/them at start of course.
Savitribai Phule Pune University, Pune  
Second Year Information Technology (2019 Course)  
214450 (D) : Mandatory Audit Course 3:  
Cyber Security and Law

<table>
<thead>
<tr>
<th>Teaching Scheme:</th>
<th>Credit Scheme:</th>
<th>Examination Scheme:</th>
</tr>
</thead>
<tbody>
<tr>
<td>01hrs/week</td>
<td>Non Credit</td>
<td>Audit Course</td>
</tr>
</tbody>
</table>

**Prerequisite Courses, if any:** Basics of Computer

**Course Objectives:**
1. Understand basics of computer and cyber security.
2. To study the information technology law.
3. To understand reasons for cybercrime.
4. To learn investigation techniques.

**Course Outcomes:**
On completion of the course, learner will be able to --

- **CO1:** Understand the basic concepts of cyber security and its abilities
- **CO2:** Analyse and evaluate the cyber security needs of an organization.
- **CO3:** Understand the importance of cyber laws and its practices.
- **CO4:** Determine and analyse software vulnerabilities and security solutions to reduce the risk of exploitation

**COURSE CONTENTS**

<table>
<thead>
<tr>
<th>Unit I</th>
<th>Basics of Cyber Security</th>
<th>04 hrs</th>
</tr>
</thead>
</table>

**Mapping of Course Outcomes for Unit I**  
CO1, CO2

<table>
<thead>
<tr>
<th>Unit II</th>
<th>Cyber Laws</th>
<th>04 hrs</th>
</tr>
</thead>
</table>

**Mapping of Course Outcomes for Unit II**  
CO2, CO3, CO4

<table>
<thead>
<tr>
<th>Unit III</th>
<th>Cyber Crime</th>
<th>04 hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Definition of Cyber Crime &amp; Computer related Crimes, Classification &amp; Differentiation between traditional crime and cybercrimes, Data Theft, Hacking, Spreading Virus &amp; Worms, Phishing, Cyber Stalking/ Bullying, Identity Theft &amp; Impersonation, Credit card &amp; Online Banking Frauds, Denial of Service Attacks, Cyber terrorism etc., Search and Seizure Procedures of Digital Evidence- Data</td>
<td></td>
</tr>
</tbody>
</table>
Mapping of Course Outcomes for Unit III

<table>
<thead>
<tr>
<th>CO2, CO3, CO4</th>
</tr>
</thead>
</table>

**Text Books:**

6. “The Information Technology Act, 2000; Bare Act” – Professional Book Publishers

**Evaluation:**

Students should select any one of the topic in a group of 3 to 5. Students should submit a written report and make a presentation on the topic. The task should not be repeated among students. Report will be evaluated by the faculty as per rubrics defined by him/her/them at start of course.
SEMESTER – IV
Savitribai Phule Pune University, Pune
Second Year Information Technology (2019 Course)

207003: Engineering Mathematics III

<table>
<thead>
<tr>
<th>Teaching Scheme:</th>
<th>Credit Scheme:</th>
<th>Examination Scheme:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory (TH) : 03 hrs/week</td>
<td>03</td>
<td>Mid_Semester: 30 Marks</td>
</tr>
<tr>
<td>Tutorial (TUT) : 01 hrs/week</td>
<td>01</td>
<td>End_Semester: 70 Marks</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TW : 25 Marks</td>
</tr>
</tbody>
</table>

Prerequisites: Differential & Integral calculus, Taylor series, Differential equations of first order and first degree, Fourier series, Collection, Classification and Representation of data.

Course Objectives:
2. The aim is to equip them with the techniques to understand advanced level mathematics and its applications that would enhance thinking power, useful in their disciplines.

Course Outcomes:
On completion of this course student will be able to –

CO1: Solve Linear differential equations, essential in modelling and design of computer-based systems.
CO2: Apply concept of Fourier transform and Z-transform and its applications to continuous and discrete systems and image processing.
CO3: Apply Statistical methods like correlation & regression analysis and probability theory for data analysis and predictions in machine learning.
CO4: Solve Algebraic & Transcendental equations and System of linear equations using numerical techniques.
CO5: Obtain Interpolating polynomials, numerical differentiation and integration, numerical solutions of ordinary differential equations used in modern scientific computing.

COURSE CONTENTS

Unit I  Linear Differential Equations  06 hrs
LDE of n\textsuperscript{th} order with constant coefficients, Complementary function, Particular integral, General method, Short methods, Method of variation of parameters, Cauchy’s & Legendre’s DE, Simultaneous & Symmetric simultaneous DE.

Unit II  Transforms  06 hrs


Unit III  Statistics  06 hrs
Measures of central tendency, Measures of dispersion, Coefficient of variation, Moments, Skewness and Kurtosis, Curve fitting: fitting of straight line, parabola and related curves,
**Correlation and Regression, Reliability of Regression Estimates.**

<table>
<thead>
<tr>
<th>Unit IV</th>
<th>Probability and Probability Distributions</th>
<th>06 hrs</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Unit V</th>
<th>Numerical Methods</th>
<th>06 hrs</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Unit VI</th>
<th>Numerical Methods</th>
<th>06hrs</th>
</tr>
</thead>
</table>

**Text Books:**


**Reference Books:**

1. Erwin Kreyszig, “Advanced Engineering Mathematics”, 10ed, Wiley India
4. S. L. Ross, “Differential Equations”, 3e, Wiley India

**Guidelines for Tutorial and Term Work:**

i) Tutorial shall be engaged in four batches (batch size of 20 students maximum) per division.

ii) Term work shall be based on continuous assessment of six assignments (one per each unit) and performance in internal tests.
### Savitribai Phule Pune University, Pune
### Second Year Information Technology (2019 Course)
### 214451: Processor Architecture

<table>
<thead>
<tr>
<th>Teaching Scheme:</th>
<th>Credit Scheme:</th>
<th>Examination Scheme:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory (TH): 03hrs/week</td>
<td>03</td>
<td>Mid_Semester: 30 Marks</td>
</tr>
<tr>
<td></td>
<td></td>
<td>End_Semester: 70 Marks</td>
</tr>
</tbody>
</table>

**Prerequisites:** Logic Design & Computer Organization

### Course Objectives:
1. To study architectural details of PIC 18 microcontroller.
2. To study applications of PIC through various interfacing devices.

### Course Outcomes:
On completion of this course student will be able to –

- **CO1:** Apprehend architecture and memory organization of PIC 18 microcontroller.
- **CO2:** Implement embedded C programming for PIC 18.
- **CO3:** Use concepts of timers and interrupts of PIC 18.
- **CO4:** Demonstrate real life applications using PIC 18.
- **CO5:** Analyze architectural details of ARM processor.

### COURSE CONTENTS

#### Unit I
**PIC Microcontroller Architecture**

**06 hrs**

**Introduction:** introduction to microcontroller, Brief history of microcontrollers, Difference between microprocessor and microcontroller, Criteria for selection of microcontroller,

**PIC18FXXX:** Features and architecture, comparison of PIC 18 series microcontrollers; PIC18F458/452 Pin out connection, Registers of PIC18F,

**Program and data memory organization:** The Program Counter and Programmable ROM space in the PIC, File register and Access bank, Bank switching in PIC18;

**Addressing modes:** Addressing modes with instruction example, Oscillator configurations, Reset operations, Brownout reset, Watchdog timer, Power down modes & Configuration registers.

### Mapping of Course Outcomes for Unit I

| CO1, CO2 |

#### Unit II
**PIC I/O Ports and Timer**

**06 hrs**

**I/O Port:** I/O Port structure with programming: I/O Port structure, I/O Port programming, I/O Bit manipulation Programming.

**Timer/Counter:** Registers used for Timer/Counter operation, Delay calculations, Programming of Timers using Embedded C.

**Case Study**

**Traffic light signal controller using Timer/Counter**

### Mapping of Course Outcomes for Unit II

| CO2, CO3 |

#### Unit III
**PIC Interrupts & Interfacing-II**

**06 hrs**
**PIC Interrupts:** Interrupt Vs Polling, IVT, Steps in executing interrupt, Sources of interrupts; Enabling and disabling interrupts, Interrupt registers, Priority of interrupts; Programming of: Timer using interrupts, External hardware interrupts, Serial communication interrupt; Interfacing of LED, Interfacing 16X2 LCD (8 bits) and Key board (4 x 4 Matrix), Interfacing Relay & Buzzer.

<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit III</th>
<th>CO2, CO3, CO4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unit IV</strong></td>
<td><strong>PIC Interfacing-II</strong></td>
</tr>
</tbody>
</table>

**CCP modes:** Capture, Compare and PWM generation; DC Motor speed control with CCP, Stepper motor interfacing with PIC, **Basics of Serial communication protocols:** Study of RS232, I2C, SPI, UART, Serial communication programming using Embedded C.

<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit IV</th>
<th>CO2, CO4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unit V</strong></td>
<td><strong>PIC Interfacing-III</strong></td>
</tr>
</tbody>
</table>

**Interfacing:** Interfacing of ADC and DAC 0808 with PIC, Temperature sensor interfacing using ADC and I2C with PIC, Interfacing of RTC (DS1306) using I2C with PIC, Interfacing of EEPROM using SPI with PIC,

**Case Study:** Home protection system, All programs in Embedded C

<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit V</th>
<th>CO2, CO4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unit VI</strong></td>
<td><strong>Current Trends in Processor Architecture</strong></td>
</tr>
</tbody>
</table>

**ARM & RISC:** ARM and RISC design philosophy, Introduction to ARM processor & its versions ARM 7, ARM 9, ARM 11, Features & advantages of ARM processor, Suitability of ARM processor in embedded applications, ARM 7 dataflow model, Programmers model. CPSR & SPSR registers, Modes of operation, Difference between PIC and ARM.

| Mapping of for Unit VI | CO5 |

**Text Books:**

**Reference Books:**
3. Microchip’s PIC18FXXX Data Sheet
Curriculum for Second Year of Information Technology (2019 Course), Savitribai Phule Pune University

Savitribai Phule Pune University, Pune
Second Year Information Technology (2019 Course)

214452: Database Management System

Teaching Scheme: Credit Scheme: Examination Scheme:
Theory(TH):03hrs/week  03  Mid_Semester: 30 Marks

| Prerequisite Courses, if any: | Discrete Mathematics |

Course Objectives:
1. The objective of the course is to present an introduction to database management system as a subject in its own right.
2. To understand the fundamental concepts of Relational Database management system.
3. To present SQL and procedural interfaces to SQL comprehensively.
4. To provide a strong formal foundation in Relational Database Concepts, database concepts, technology and practice & to introduce the concepts of Query Processing.
5. To introduce the concepts of Transaction Processing and to present the issues and techniques relating to concurrency and recovery in multi-user database environments.
6. To introduce the recent trends in database technology.

Course Outcomes:
On completion of this course student will be able to --

- **CO1**: Apply fundamental elements of database management systems.
- **CO2**: Design ER-models to represent simple database application scenarios.
- **CO3**: Formulate SQL queries on data for relational databases.
- **CO4**: Improve the database design by normalization & to incorporate query processing.
- **CO5**: Apply ACID properties for transaction management and concurrency control.
- **CO6**: Analyze various database architectures and technologies.

COURSE CONTENTS

<table>
<thead>
<tr>
<th>Unit I</th>
<th>Introduction to DBMS</th>
<th>06 hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Introduction</strong>: Basic concepts, Advantages of DBMS over file processing systems, Data abstraction, Database languages, Data models, Data independence, Components of a DBMS, Overall structure of DBMS, Multi-user DBMS architecture, System catalogs, Data Modeling: Basic concepts, Entity, attributes, relationships, constraints, keys.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Case Study</strong>: MySQL Database</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Mapping of Course Outcomes for Unit I</strong>: CO1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unit II</th>
<th>Relational Model</th>
<th>06 hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ER and EER diagrams</strong>: Components of ER model, Conventions, Converting ER diagrams into tables, Relational Model: Basic concepts, Attributes and Domains, Codd’s rules.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Relational Integrity:** Nulls, Entity, Referential integrities, Enterprise constraints, Views, Schema diagram

<table>
<thead>
<tr>
<th>Case Study</th>
<th>Mapping of Course Outcomes for Unit II</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Student / Timetable / Reservation / any data Management System</td>
</tr>
</tbody>
</table>

**Unit III**

**Introduction to SQL - PL/SQL**

| CO2
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>06 hrs</td>
</tr>
</tbody>
</table>

**Introduction to SQL:** Characteristics and advantages SQL Data Types, Literals, DDL, DML, SQL Operators Tables: Creating, Modifying, Deleting, Views: Creating, Dropping, Updation using Views, Indexes, Nulls.

**SQL DML Queries:** SELECT query and clauses, Set operations, Tuple Variables, Set comparison, Ordering of Tuples, Aggregate Functions, Nested Queries, Database Modification using SQL Insert, Update, Delete Queries, Stored Procedure, Triggers, Programmatic SQL: Embedded SQL, Dynamic SQL, ODBC

<table>
<thead>
<tr>
<th>Case Study</th>
<th>Mapping of Course Outcomes for Unit III</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Employee database system</td>
</tr>
</tbody>
</table>

**Unit IV**

**Database Design & Query Processing**

| CO3
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>06 hrs</td>
</tr>
</tbody>
</table>

**Relational Databases Design:** Purpose of Normalization, Data Redundancy and Update Anomalies, Functional Dependencies. The process of Normalization: 1NF, 2NF, 3NF, BCNF. Introduction to Query Processing: Overview, Measures of Query cost, Selection and Join operations, Evaluation of Expressions

**Introduction to Query optimization:** Estimation, Transformation of Relational Expression

<table>
<thead>
<tr>
<th>Case Study</th>
<th>Mapping of Course Outcomes for Unit IV</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Employee Database design</td>
</tr>
</tbody>
</table>

**Unit V**

**Transaction & Concurrency Control**

| CO4
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>06 hrs</td>
</tr>
</tbody>
</table>

**Transaction Management:** Basic concept of a Transaction, Properties of Transactions, Database Architecture, Concept of Schedule, Serial Schedule.

**Serializability:** Conflict and View, Cascaded aborts Recoverable and Non-recoverable Schedules.

**Concurrency Control:** Need Locking methods Dead locks, Time stamping Methods. Optimistic Techniques, Multi-version Concurrency Control.

**Different crash recovery methods:** Shadow-Paging, Log-based Recovery: Deferred and Immediate, Check Points

<table>
<thead>
<tr>
<th>Case Study</th>
<th>Mapping of Course Outcomes for Unit V</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Banking Transaction</td>
</tr>
</tbody>
</table>
## Unit VI

### Advanced Databases

<table>
<thead>
<tr>
<th>Database Architectures:</th>
<th>Centralized and Client-Server Architectures, 2 Tier and 3 Tier Architecture, Introduction to Parallel Databases, Key elements of Parallel Database Processing, Architecture of Parallel Databases, Introduction to Distributed Databases, Architecture of Distributed Databases, Distributed Database Design.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emerging Database Technologies:</td>
<td>Introduction, No SQL Databases- Internet Databases, Cloud databases, Mobile Databases, SQLite database, XML databases</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Case Study</th>
<th>RealmDB, ORMLite, Couchbase Lite</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mapping of Course Outcomes for Unit VI</td>
<td>CO6</td>
</tr>
</tbody>
</table>

### Text Books:


### Reference Books:


### Web Resources:

https://nptel.ac.in/courses/106/105/106105175/
Savitribai Phule Pune University, Pune
Second Year Information Technology (2019 Course)

214453: Computer Graphics

Teaching Scheme:  Credit Scheme:  Examination Scheme:
Theory (TH): 03 hrs/week  03  Mid_Semester: 30 Marks

Mid_Semester: 30 Marks
End_Semester: 70 Marks

Prerequisite Courses, if any: Basic Geometry, Trigonometry, Vectors and Matrices, Data Structures and Algorithms

Course Objectives:
1. Understand the foundations of computer graphics: hardware systems, math basis, light and color.
2. Understand the complexities of modeling realistic objects through modeling complex scenes using a high-level scene description language.
3. Become acquainted with some advanced topics in computer graphics. The student should gain an expanded vocabulary for discussing issues relevant to computer graphics (including both the underlying mathematics and the actual programming).
4. The student should gain an appreciation and understanding of the hardware and software utilized in constructing computer graphics applications.
5. The student should gain a comprehension of windows, clipping and view-ports in relation to images displayed on screen.
6. The student should gain an understanding of geometric, mathematical and algorithmic concepts necessary for programming computer graphics.

Course Outcomes:
On completion of the course, students will be able to–

CO1: Apply mathematical and logical aspects for developing elementary graphics operations like scan conversion of points, lines, circle, and apply it for problem solving.

CO2: Employ techniques of geometrical transforms to produce, position and manipulate Objects in 2 dimensional and 3-dimensional space respectively.

CO3: Describe mapping from a world coordinates to device coordinates, clipping, and projections in order to produce 3D images on 2D output device.

CO4: Apply concepts of rendering, shading, animation, curves and fractals using computer graphics tools in design, development and testing of 2D, 3D modeling applications.

CO5: Perceive the concepts of virtual reality.

COURSE CONTENTS

<table>
<thead>
<tr>
<th>Unit – I</th>
<th>Computer Graphics Basic, OpenGL and Line, Circle Drawing</th>
<th>06 hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction CG</td>
<td>Introduction to computer graphics, basics of graphics systems, raster and random scan, basic display processor</td>
<td></td>
</tr>
<tr>
<td>OpenGL</td>
<td>Introduction – Graphics function, OpenGL Interface, primitives and attributes, Control functions, programming events.</td>
<td></td>
</tr>
</tbody>
</table>
**Line Drawing:** DDA Line drawing algorithm, Bresenham Line drawing algorithm

**Circle Drawing:** Bresenham circle drawing algorithm.

**Character Generation:** Stroke principle, starburst principle, bitmap method. Introduction to aliasing and anti-aliasing.

<table>
<thead>
<tr>
<th>Case Study</th>
<th>Computer-generated imagery (CGI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mapping of Course Outcomes for Unit I</td>
<td>CO1</td>
</tr>
</tbody>
</table>

**Unit – II**

**Polygons:** Polygons and its types, inside test, 
Polygon filling methods: Seed Fill – Flood fill and Boundary Fill, Scan-line Fill algorithms,

**2D Transformations:** Translation, Scaling, Rotation, Reflection and Shearing, Matrix representation and homogeneous coordinate system, composite transformations.

<table>
<thead>
<tr>
<th>Case Study</th>
<th>Transformation of an Object in Computer Graphics: Mathematical Matrix Theory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mapping of Course Outcomes for Unit II</td>
<td>CO2</td>
</tr>
</tbody>
</table>

**Unit – III**

**Windowing:** Concept of window and viewport, viewing transformations

**Line Clipping:** Cohen Sutherland method of line clipping

**Polygon Clipping:** Sutherland Hodgeman method for convex and concave polygon clipping.

**3D Transformation:** Translation, scaling, rotation about X, Y, Z & arbitrary axis, and reflection about XY, YZ, XZ & arbitrary plane.

**Projections:** Types of projections- Parallel, Perspective

**Parallel:** oblique – Cavalier, Cabinet, Orthographic – isometric, diametric, trimetric

**Perspective:** vanishing points as 1 point, 2 point and 3 point.

<table>
<thead>
<tr>
<th>Case Study</th>
<th>3D Rendering and Modeling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mapping of Course Outcomes for Unit III</td>
<td>CO2 &amp; CO3</td>
</tr>
</tbody>
</table>

**Unit – IV**

**Segments:** Introduction, Segment table, segment creation, closing, deleting, renaming, and visibility.

**Illumination models:** Light sources, ambient light, diffuse light, specular reflection, the Phong model, combined diffuse and specular reflections with multiple light sources.

**Color Models:** CIE Chromaticity Diagram, Color Gamut, RGB, CMY, YCbCr, HSVcolor models.

**Shading Algorithms:** Constant intensity shading, Halftone, Gourand and Phong Shading.

<table>
<thead>
<tr>
<th>Case Study</th>
<th>Best practices in Day lighting &amp; Passive Systems for Smaller Commercial Buildings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mapping of Course Outcomes for Unit IV</td>
<td>CO4</td>
</tr>
</tbody>
</table>
## Unit – V

### Curves, fractals and Animation | 06 hrs
---
**Curves:** Introduction, interpolation and approximation, Spline Interpolation Methods – hermite interpolation, Bezier curves, B-Splines.

**Fractals:** Introduction, Classification, fractal Dimension, Fractal dimension and surfaces, Hilbert curve, Koch Curve.

**Animation:** Basics of animation, types of animation, principles of animation, design of animation sequences, animation languages, key frame, morphing, motion specification.

Methods of controlling animation, frame-by-frame animation techniques, real-time animation techniques.

### Case Study

3D Animation services for character expressions.

### Mapping of Course Outcomes for Unit V

| CO4 |

## Unit – VI

### Virtual Reality | 06 hrs
---
**Introduction of Virtual Reality:** Fundamental Concept, Three I’s of virtual reality and Classic Components of VR systems, Applications of VR systems.

**Multiple Modals of Input and Output Interface in Virtual Reality:** Input – 3D position Trackers and its types, Navigation and Manipulation Interfaces, Gesture Interfaces, Graphics Displays – HMD and CAVE, Sound Displays, Haptic Feedback


### Case Study

Virtual reality in aviation and Space travel Training

### Mapping of Course Outcomes for Unit VI

| CO5 |

## Test Books


## Reference books

Savitribai Phule Pune University, Pune
Second Year Information Technology (2019 Course)

214454: Software Engineering

Teaching Scheme:
Theory (TH) : 03 hrs/week
Credit Scheme:
03
Examination Scheme:
Mid_Semester: 30 Marks
End_Semester: 70 Marks

Prerequisite Courses, if any: Fundamentals of Programming Languages

Course Objectives:
1. To learn the principles of Software Engineering.
2. To learn and understand methods of capturing, specifying, visualizing and analyzing software requirements.
3. To know design principles to software project development.
4. To learn basics of IT project management.
5. To understand software quality attributes and testing principles.
6. To introduce formal methods and recent trends in Software Engineering.

Course Outcomes:
On completion of the course, students will be able to --
CO1: Classify various software application domains.
CO2: Analyze software requirements by using various modeling techniques.
CO3: Translate the requirement models into design models.
CO4: Apply planning and estimation to any project.
CO5: Use quality attributes and testing principles in software development life cycle.
CO6: Discuss recent trends in Software engineering by using CASE and agile tools.

COURSE CONTENTS

<table>
<thead>
<tr>
<th>Unit</th>
<th>Introduction To Software Engineering</th>
<th>06 hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Agile software development: Agile manifesto, agility principles, Agile methods, myth of planned development, Introduction to Extreme programming and Scrum.
Agile Practices: test driven development, pair programming, continuous integration in DevOps, Refactoring

Case Study
An information system – Library Management system

Mapping of Course Outcomes for Unit I
CO1

Unit II
Requirements Engineering & Analysis | 06 hrs

Requirements Engineering: User and system requirements, Functional and non-functional requirements, requirements engineering (elicitation, specification, validation, negotiation) prioritizing requirements (Kano diagram), requirement traceability matrix(RTM)
Software Requirements Specification (SRS): software requirements Specification document,
structure of SRS, writing a SRS, structured SRS for online shopping,

**Requirements Analysis:** Analysis Model, data modeling, scenario based modeling, class based modeling, Flow oriented modeling, behavioral modeling - Introduction to UML diagrams

**Case Study:** Library Management system

<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit II</th>
<th>CO2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unit III</strong></td>
<td><strong>Design Engineering</strong></td>
</tr>
</tbody>
</table>


**Component level Design:** component, Designing class based components, conducting component-level design, User Interface Design: The golden rules, Interface Design steps & Analysis, Design Evaluation

**Case Study:** Web App Design / Library Management System

<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit III</th>
<th>CO3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unit IV</strong></td>
<td><strong>Project Planning, Management And Estimation</strong></td>
</tr>
</tbody>
</table>

**Project Planning:** Project initiation, Planning Scope Management, Creating the Work Breakdown Structure, scheduling: Importance of Project Schedules, Developing the Schedule using Gantt Charts, PERT/CPM


**Project Estimation:** Software Project Estimation, Decomposition Techniques, Cost Estimation Tools and Techniques, Typical Problems with IT Cost Estimates.

**Case Study:** Project Management tool like OpenProj or MS Project

<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit IV</th>
<th>CO4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unit V</strong></td>
<td><strong>Software Quality And Testing</strong></td>
</tr>
</tbody>
</table>

**Quality Concepts:** Quality, software quality, Quality Metrics, software quality dilemma, achieving software quality


**Case Study:** Software testing tool like selenium

<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit V</th>
<th>CO5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unit VI</strong></td>
<td><strong>Formal Methods Recent Trends In Software Engineering</strong></td>
</tr>
</tbody>
</table>

**Recent Trends in SE:** SCM, Risk Management, Technology evolution, process trends, collaborative development, software reuse, test-driven development, global software development challenges, CASE – taxonomy, tool-kits, workbenches, environments, components of CASE, categories (upper, lower and integrated CASE tools), Introduction to agile tools Jira, Kanban

**Case Study:** CASE software/ HP Quality Center (QC) / Jira
<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit VI</th>
<th>CO6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Text Books:</strong></td>
<td></td>
</tr>
</tbody>
</table>

| **Reference Books:**                     |     |
Savitribai Phule Pune University, Pune  
Second Year Information Technology (2019 Course) 

214455: Programming Skill Development Lab

<table>
<thead>
<tr>
<th>Teaching Scheme</th>
<th>Credit Scheme: 01</th>
<th>Examination Scheme: PR: 25MarksTW: 25Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory(TH): 02hrs/week</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Prerequisites:** Computer Organization and Architecture

**Course Objectives:**
1. To learn embedded C programming and PIC18FXXX microcontrollers.
2. To learn interfacing of real-world input and output devices to PIC18FXXX microcontroller

**Course Outcomes:**
On completion of this course student will be able to --

- **CO1:** Apply concepts related to embedded C programming.
- **CO2:** Develop and Execute embedded C program to perform array addition, block transfer, sorting operations
- **CO3:** Perform interfacing of real-world input and output devices to PIC18FXXX microcontroller.
- **CO4:** Use source prototype platform like Raspberry-Pi/Beagle board/Arduino.

**Guidelines for Instructor’s Manual**
The faculty member should prepare the laboratory manual for all the experiments and it should be made available to students and laboratory instructor/Assistant. The instructor's manual should include prologue, university syllabus, conduction & Assessment guidelines, topics under consideration- concept, objectives, outcomes, algorithm, sample test cases etc.

**Guidelines for Student’s Lab Journal**
1. The laboratory assignments should be submitted by students in the form of journal. The Journal consists of Certificate, table of contents, and write-up of each assignment (Title, Objectives, Problem Statement, Outcomes, software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory- Concept, circuit diagram, pin configuration, conclusion/analysis).
2. As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of program listing to journal may be avoided.
3. Use of Digital media like shared drive containing students' programs maintained by lab In-charge is highly encouraged.
4. Practical Examination will be based on the term work submitted by the student in the form of journal.
5. Candidate is expected to know the theory involved in the experiment.
6. The practical examination should be conducted if the journal of the candidate is completed in all respects and certified by concerned faculty and head of the department.
7. All the assignment mentioned in the syllabus must be conducted.

**Guidelines for Lab /TW Assessment**
1. Examiners will assess the term work based on performance of students considering the parameters such as timely conduction of practical assignment, methodology adopted for
implementation of practical assignment, timely submission of assignment in the form of write-up along with results of implemented assignment, attendance etc.

2. Examiners will judge the understanding of the practical performed in the examination by asking some questions related to theory & implementation of experiments he/she has carried out.

3. Necessary knowledge of usage of software and hardware of PIC18FXXX microcontrollers and its interfacing kits should be checked by the concerned faculty members.

### Guidelines for Laboratory Conduction

The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The instructor may set multiple sets of assignments and distribute among batches of students. It is appreciated if the assignments are based on real world problems/applications.

### Guidelines for Practical Examination

Both internal and external examiners should jointly set problem statements for practical examination. During practical assessment, the expert evaluator should give the maximum weightage to the satisfactory implementation of the problem statement. The supplementary and relevant questions may be asked at the time of evaluation to judge the student’s understanding of the fundamentals, effective and efficient implementation. The evaluation should be done by both external and internal examiners.

### Suggested List of Laboratory Assignments

#### Mapping of Course Outcomes for Group A -- CO1, CO2

1. Study of Embedded C programming language (Overview, syntax, One simple program like addition of two numbers).
2. Write an Embedded C program to add array of n numbers.
3. Write an Embedded C program to transfer elements from one location to another for following:
   i) Internal to internal memory transfer
   ii) Internal to external memory transfer
4. Write an Embedded C menu driven program for:
   i) Multiply 8 bit number by 8 bit number
   ii) Divide 8 bit number by 8 bit number
5. Write an Embedded C program for sorting the numbers in ascending and descending order.

#### Mapping of Course Outcomes for Group B -- CO3

6. Write an Embedded C program to interface PIC 18FXXX with LED & blinking it using specified delay.
7. Write an Embedded C program for Timer programming ISR based buzzer on/off.
8. Write an Embedded C program for External interrupt input switch press, output at relay.
9. Write an Embedded C program for LCD interfacing with PIC 18FXXX.

#### Mapping of Course Outcomes for Group C -- CO3

68
10. Write an Embedded C program for Generating PWM signal for servo motor/DC motor.
11. Write an Embedded C program for PC to PC serial communication using UART.
12. Write an Embedded C program for Temperature sensor interfacing using ADC & display on LCD.

**Group D:**

**Mapping of Course Outcomes for Group D -- CO4**

13. Study of Arduino board and understand the OS installation process on Raspberry-pi.
14. Write simple program using Open source prototype platform like Raspberry-Pi/Beagle board/Arduino for digital read/write using LED and switch Analog read/write using sensor and actuators.

**Reference Books :**

1. Mazidi, Rolin McKinlay and Danny Causey, ‘PIC Microcontroller and Embedded Systems using Assembly and C for PIC18”, Pearson Education
**Course Objectives:**
1. Understand the fundamental concepts of database management. These concepts include aspects of database design, database languages, and database-system implementation.
2. To provide a strong formal foundation in database concepts, recent technologies and best industry practices.
3. To give systematic database design approaches covering conceptual design, logical design and an overview of physical design.
4. To learn the SQL database system.
5. To learn and understand various Database Architectures and its use for application development.
6. To program PL/SQL including stored procedures, stored functions, cursors and packages.

**Course Outcomes:**
On completion of this course student will be able to --
- **CO1:** Install and configure database systems.
- **CO2:** Analyze database models & entity relationship models.
- **CO3:** Design and implement a database schema for a given problem-domain
- **CO4:** Implement relational database systems.
- **CO5:** Populate and query a database using SQL DDL / DML / DCL commands.
- **CO6:** Design a backend database of any one organization: CASE STUDY

**Guidelines for Instructor’s Manual**
The faculty member should prepare the laboratory manual for all the experiments and it should be made available to students and laboratory instructor/Assistant.

**Guidelines for Student’s Lab Journal**
1. Student should submit term work in the form of journal with write-ups based on specified list of assignments.
2. Practical and Oral Examination will be based on all the assignments in the lab manual
3. Candidate is expected to know the theory involved in the experiment.
4. The practical examination should be conducted only if the journal of the candidate is complete in all respects.

**Guidelines for Oral /Practical Assessment**
1. Examiners will assess the student based on performance of students considering the parameters such as timely conduction of practical assignment, methodology adopted for implementation of practical assignment, timely submission of assignment in the form of
handwritten write-up along with results of implemented assignment, attendance etc.

2. Examiners will judge the understanding of the practical performed in the examination by asking some questions related to theory & implementation of experiments he/she has carried out.

3. Appropriate knowledge of usage of software and hardware related to respective laboratory should be checked by the concerned faculty member.

**Suggested List of Laboratory Assignments**

<table>
<thead>
<tr>
<th>Mapping of Course Outcomes Group A -- CO1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Study of MySQL Open source software. Discuss the characteristics like efficiency, scalability, performance and transactional properties</td>
</tr>
<tr>
<td>2. Install and configure client and server of MySQL. (Show all commands and necessary steps for installation and configuration)</td>
</tr>
</tbody>
</table>

**Group B: MySQL**

**Mapping of Course Outcomes Group B -- CO2, CO3, CO4, CO5**

1. Design any database with at least 3 entities and relationships between them. Draw suitable ER/EER diagram for the system.
2. Design and implement a database (for assignment no 1) using DDL statements and apply normalization on them
3. Create Table with primary key and foreign key constraints.
   a. Alter table with add n modify  
   b. Drop table
4. Perform following SQL queries on the database created in assignment 1.
   - Implementation of relational operators in SQL
   - Boolean operators and pattern matching
   - Arithmetic operations and built in functions
   - Group functions
   - Processing Date and Time functions
   - Complex queries and set operators
5. Execute DDL/DML statements which demonstrate the use of views. Update the base table using its corresponding view. Also consider restrictions on updatable views and perform view creation from multiple tables.

**Group C: PL/SQL**

**Mapping of Course Outcomes Group C -- CO6**

1. Write and execute PL/SQL stored procedure and function to perform a suitable task on the database. Demonstrate its use.
2. Write and execute suitable database triggers. Consider row level and statement level triggers.
3. Write a PL/SQL block to implement all types of cursor.

**Group D: Relational Database Design**

**Mapping of Course Outcomes Group D -- CO5, CO6**
Design and case study of any organization (back end only), Project Proposal and High Level SRS

To prepare for project, do the following:
1. Form teams of around 3 to 4 people
2. Create requirements document with the following information:-
   a. Give one or two paragraph description of your goals for the topic(s).
   b. List what all types of users will be accessing your application
   c. List the various functionalities that your application will support. Explain each in about a paragraph worth of detail.
   d. List the hardware and software requirements at the backend and at the front end.
   e. Give an estimate of the number of users of each type, the expected load (transactions per day), and the expected database size.

Project ER Diagram and Database Design

For ER diagram and database design following guidelines can be used:
1. Draw an ER diagram of your project.
2. Reduce this ER diagram into the tables and complete database design.
3. Subsequently, list all the functional dependencies on each table that you expect will hold.
4. Check that the database schema is in 3NF/BCNF. If it is not, apply normalization. Use non-loss decomposition and bring the database schema in 3NF/BCNF.

Give the ER diagram and the data dictionary as part of the requirement specifications file which you created for the project proposal.

Reference Books:
1. Dr. P. S. Deshpande, “SQL and PL/SQL for Oracle 10g Black Book”, DreamTech
Savitribai Phule Pune University, Pune
Second Year Information Technology (2019 Course)

214457: Computer Graphics Lab

Teaching Scheme: 

<table>
<thead>
<tr>
<th>Credit Scheme:</th>
<th>Examination Scheme:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practical (PR)</td>
<td>02</td>
</tr>
<tr>
<td>:02hrs/week</td>
<td>PR: 25 Marks</td>
</tr>
<tr>
<td></td>
<td>TW: 25 Marks</td>
</tr>
</tbody>
</table>

Prerequisites: Basic Geometry, Trigonometry, Vectors and Matrices, Data Structures and Algorithms

Course Objectives:

1. To acquaint the learners with the concepts of OpenGL.
2. To acquaint the learners with the basic concepts of Computer Graphics.
3. To implement the various algorithms for generating and rendering the objects.
4. To get familiar with mathematics behind the transformations.
5. To understand and apply various methods and techniques regarding animation.

Course Outcomes:

On completion of this course student will be able to --

CO1: Apply line & circle drawing algorithms to draw the objects.
CO2: Apply polygon filling methods for the object.
CO3: Apply polygon clipping algorithms for the object.
CO4: Apply the 2D transformations on the object.
CO5: Implement the curve generation algorithms.
CO6: Demonstrate the animation of any object using animation principles.

Guidelines for Instructor’s Manual

The faculty member should prepare the laboratory manual for all the experiments and it should be made available to students and laboratory instructor/Assistant.

Guidelines for Student’s Lab Journal

1. Student should submit term work in the form of journal with write-ups based on specified list of assignments.
2. Practical and Oral Examination will be based on all the assignments in the lab manual.
3. Candidate is expected to know the theory involved in the experiment.
4. The practical examination should be conducted if and only if the journal of the candidate is complete in all respects.

Guidelines for Lab /TW Assessment

1. Examiners will assess the student based on performance of students considering the parameters such as timely conduction of practical assignment, methodology adopted for implementation of practical assignment, timely submission of assignment in the form of write-ups along with results of implemented assignment, attendance etc.
2. Examiners will judge the understanding of the practical performed in the examination by asking some questions related to theory & implementation of experiments he/she has carried.
out.
3. Appropriate knowledge of usage of software related to respective laboratory should be checked by the concerned faculty member.

Guidelines for Laboratory Conduction
1. All the assignments should be implemented in C++ with OpenGL libraries.
2. Assignment 1 (week 1) should cover all the basic functions of OpenGL to get students familiar with Graphics Environment. Hence, this assignment is not included in Practical Exam.
3. The different objects/shapes/patterns should be drawn for implementation of drawing algorithm.
4. All the assignments should explore the conceptual understanding of students.
5. The keyboard/Mouse interfaces should be used wherever possible.

Guidelines for PRACTICAL EXAM conduction
1. There will be 2 problem statements options and student will have to perform any one.
2. All the problem statements carry equal weightage.

Virtual Laboratory
- https://cse18-iiith.vlabs.ac.in/
- http://vlabs.iitb.ac.in/vlabs-dev/labs/cglab/index.php

Suggested List of Laboratory Assignments
1. Install and explore the OpenGL – CO1

2. Implement DDA and Bresenham line drawing algorithm to draw: i) Simple Line ii) Dotted Line iii) Dashed Line iv) Solid line ; using mouse interface Divide the screen in four quadrants with center as (0, 0). The line should work for all the slopes positive as well as negative.

3. Implement Bresenham circle drawing algorithm to draw any object. The object should be displayed in all the quadrants with respect to center and radius- CO2

4. Implement the following polygon filling methods : i) Flood fill / Seed fill ii) Boundary fill ; using mouse click, keyboard interface and menu driven programming- CO4

5. Implement Cohen Sutherland polygon clipping method to clip the polygon with respect the viewport and window. Use mouse click, keyboard interface - CO4

6. Implement following 2D transformations on the object with respect to axis : – CO5
   i) Scaling  ii) Rotation about arbitrary point iii) Reflection

7. Generate fractal patterns using i) Bezier ii) Koch Curve - CO5

8. Implement animation principles for any object - CO6

Text Books
### Reference Books

<table>
<thead>
<tr>
<th>Reference Book</th>
<th>Publisher/Date</th>
<th>ISBN</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Zhigang Xiang, Roy Plastock, Computer Graphics</td>
<td>Schaum’s Series outlines</td>
<td></td>
</tr>
</tbody>
</table>
Savitribai Phule Pune University, Pune
Second Year Information Technology (2019 Course)

214458: Project Based Learning

Teaching Scheme: Credit Scheme: Examination Scheme:
Practical (PR): 04hrs/week 02 TW: 50 Marks

Prerequisite Courses, if any:

Preamble:
Project Based Learning (PBL) is an instructional approach that emphasizes critical-thinking, collaboration and personalized learning. In PBL, student groups engage in meaningful inquiry that is of personal interest to them. These projects are based on problems, which are real-life oriented, curriculum-based and often interdisciplinary. Students decide how to approach a problem and what activities or processes they will perform. They collect information from a variety of sources, analyze, synthesize and derive understanding from it. The real-world focus of PBL activities is central to the process because it motivates students and adds value to their work. Their learning is connected to something real and involves life skills such as collaboration and reflection. The faculty assigned to the group is referred as mentor. Technology enables students and Mentor in various phases of the PBL process. At the end of the PBL, students demonstrate their newly acquired knowledge and are evaluated by how much they have learned and how well they communicate it. Students also conduct self-evaluation to assess their own growth and learning. Throughout this process, the mentor’s role is to guide and advise students, rather than to direct and manage student work.

Companion Course: Online courses relevant to the project, along with expert lecture on Intellectual property rights, patents and software engineering.

Course Objectives:
1. To learn the various processes involved in project based learning.
2. To develop critical thinking and engineering problem solving skills amongst the students.
3. To explain the roles and responsibilities of IT engineers to the solution of engineering problems within the social, environmental and economic context.
4. To equip the students with knowledge and skills require to develop solutions for the problems coming from various Hackathon.

Course Outcomes
On completion of the course, student will be able to:

- **CO1:** Design solution to real life problems and analyze its concerns through shared cognition.
- **CO2:** Apply learning by doing approach in PBL to promote lifelong learning.
- **CO3:** Tackle technical challenges for solving real world problems with team efforts.
- **CO4:** Collaborate and engage in multi-disciplinary learning environments.
**COURSE CONTENTS**

**Group Structure**

Group structure should enable students to work in mentor–monitored groups. The students plan, manage and complete a task/project / activity which addresses the stated problem.

1. There should be a team of 3 to 6 students who will work cohesively.
2. A Mentor should be assigned to individual groups who will help them with learning and development process.

**Selection of Project/Problem**

1. The project scope/topic can be from any field/area, but selection related to IT technical aspect is desirous.
2. The project/problem done in first year engineering could be extended further, based on its potential and significance analysis.
3. Project/problem requiring solutions through conceptual model development and use of software tools should be preferred.
4. Different alternate approaches such as theoretical, practical, working model, demonstration or software analysis should be used in solving/implementing of project/problem.
5. The project/problem requiring multi-disciplinary approach to solve it, should be preferred.
6. Problem may require in depth study of specific practical, scientific or technical domain.
7. Hands-on activities, organizational and field visits, interacting with research institutes and expert consultation should be included in the approach to make students aware of latest technologies.

**Assessment**

The department should be committed to assess and evaluate both student performance and solution impact.

Progress of PBL will be monitored regularly on weekly basis. Weekly review of the work is necessary. During process of monitoring and continuous assessment and evaluation the individual and team performance is to be measured by mentor.

Students must maintain an institutional culture of authentic collaboration, self- motivation, peer-learning and personal responsiveness. The institution/department should support students in this regard through guidance/orientation programs and the provision of appropriate resources and services. Supervisor/mentor and students must actively participate in assessment and evaluation processes. Group may demonstrate their knowledge and skills by developing a public product and/or report and/or presentation.

1. Individual assessment for each student (Understanding individual capacity, role and involvement in the project).
2. Group assessment (roles defined, distribution of work, intra-team communication and togetherness.
3. Documentation and presentation.
**Evaluation and Continuous Assessment**

It is recommended that the all activities are to be recorded in PBL workbook, regular assessment of work to be done and proper documents are to be maintained at college end by both students as well as mentor.

The PBL workbook will reflect accountability, punctuality, technical writing ability and work flow of the task undertaken. Continuous Assessment Sheet (CAS) is to be maintained by all mentors/department.

**Recommended parameters for assessment, evaluation and weightage:**

1. Idea Inception (5%)
2. Outcomes of PBL/Problem Solving Skills/Solution provided/Final product (40%) (Individual assessment and team assessment)
3. Documentation (Gathering requirements, design & modeling, implementation/execution, use of technology and final report, other documents (25 %)
4. Potential for the patent (10%)
5. Demonstration (Presentation, User Interface, Usability etc.) (10%) 
6. Contest Participation/ publication (5%)
7. Awareness/Consideration of Environment/ Social/ Ethics/ Safety measures/Legal aspects (5%).

Design the rubrics based on the above parameters for evaluation of student performance

**Faculty/ Mentor is expected to perform following activities**

- Revision of PBL concepts
- Skill assessment of students
- Formation of diversified and balanced groups
- Share information about patent, copyright and publications to make students aware about it
- Discussion of sample case studies
- Design of the rubrics for evaluation of student performance
- Discussion of the rubrics with students
- Weekly Assessment of the deliverables such as Presentation, Report, Concept map, logbook
- Scaffolding of the students
- Summative and Formative assessment

**Reference Books:**

1. Project-Based Learning, Edutopia, March 14,2016.
2. What is PBL? Buck Institute for Education.
3. www.schoology.com
4. www.wikipedia.org
5. www.howstuffworks.com
Prerequisite Courses: Basic knowledge of environmental science and mathematics

Course Objectives:
1. Enable the student to understand the various components of environment in and around the earth crust and understand the effects of it over plants, animals, etc
2. Understand the important concepts of good water supply system to a city/town or a village
3. Understand the need of conservation of rain water and its applications
4. Understand the sources, effects, prevention and control measures of water pollution and its legislative aspects.

Course Outcomes:
On completion of the course, learner will be able to –

CO1: Relate the relations between the environment and ecology, estimating water requirement for public water supply scheme.

CO2: Assess the quality of water as per BIS and select the appropriate treatment method required for the water source.

CO3: Analyze the suitable distribution system for a locality and know the appurtenances used.

CO4: Summarize the arrangement of water supply and fittings in a building.

CO5: Determine the need of conservation of water and rural water supply.

CO6: Identify the sources of water pollution and suitable control measures.

COURSE CONTENTS

Unit I Introduction To Environment, Water Requirement And Water Sources 02 hrs


SOURCES OF WATER: Surface Sources - Lakes, Streams, Rivers. Impounded Reservoirs. Underground Sources - Infiltration Galleries, Infiltration Wells and Springs

Mapping of Course Outcomes for Unit I

Unit II Quality And Treatment Of Water 02 hrs

**TREATMENT OF WATER:** Flow diagram of different units of treatment, brief description of constructional details, working and operation of the following units - plain sedimentation, sedimentation with coagulation, flocculation, filtration - Slow sand filters, Rapid sand filters and pressure filters (nodesign) Disinfection of water, Chlorination

<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit II</th>
<th>CO2</th>
</tr>
</thead>
</table>

**Unit III Water Distribution System** 02 hrs


**APPUR Tenances IN DISTRIBUTION SYSTEM:** Use of Sluice Valves, Check Valves, Air Valves, Scour Valves, Zero Velocity Valves, Fire Hydrants, Water Meter

<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit III</th>
<th>CO3</th>
</tr>
</thead>
</table>

**Unit IV Water Supply In Buildings** 02 hrs


<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit IV</th>
<th>CO4</th>
</tr>
</thead>
</table>

**Unit V Water Conservation** 02 hrs

**WATER CONSERVATION:** Conservation of rain water, roof water harvesting, recharging of ground water. RURAL WATER SUPPLY: Rural water supply systems, Disinfection of well water.

**Case Studies:** Refer suggested list of Case studies/ Students activities

<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit V</th>
<th>CO5</th>
</tr>
</thead>
</table>

**Unit VI Water Pollution And Pollution control** 02 hrs

**WATER POLLUTION AND CONTROL:** Sources of water pollution, types and its effects, Prevention and control measures of water pollution, Legal aspects regarding water pollution control.
### Mapping of Course Outcomes for Unit V

<table>
<thead>
<tr>
<th>CO6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mapping of Course Outcomes for Unit V</td>
</tr>
</tbody>
</table>

### Reference Books:
3. Dr. P.N. Modi, Environmental Engg.-Vol-I, Standard BookHouse

### Suggested List of Case Studies/Student Activities

1. Collect the information about biotic and a biotic component of surrounding environment and frame relation among them
2. Estimate the total quantity of water required for a town/locality/Institute
3. Prepare map and written report for surface and underground sources of water in the neighborhood
4. Visit nearby Certified Water testing laboratories and identify various tests conducted on water
5. Visit Water Treatment Plant and collect details of unit operations and processes involved in it.
6. Study the distribution system of water supply of your locality
7. Visit a newly constructed building and study plumbing work
8. Study a rooftop rain water harvesting system of existing building
9. Study a Solar water heating system and collect necessary data
10. Collect a necessary data/information about issues related to water pollution and Prepare report/presentation

### Evaluation:

Students should select any one of the above topic in a group of 3 to 5. Students should submit a written report and make a presentation on the topic. The task should not be repeated among students. Report will be evaluated by the faculty as per rubrics defined by him/her/them at start of course.
Savitribai Phule Pune University, Pune
Second Year Information Technology (2019 Course)

214459 (B): Mandatory Audit course 4 :
Language Study Japanese : Module - II

<table>
<thead>
<tr>
<th>Teaching Scheme:</th>
<th>Credit Scheme:</th>
<th>Examination Scheme:</th>
</tr>
</thead>
<tbody>
<tr>
<td>01hrs/week</td>
<td>Non Credit</td>
<td>Audit Course</td>
</tr>
</tbody>
</table>

**Prerequisite Courses:** Audit Course 3: Language Study Japanese: Module-I

**Course Objectives:**
1. To develop the Japanese communicative competence of students with small sentence formation to make primitive social conversation in Japanese.
2. To enable students with comprehension ability of Japanese grammar.
3. To enable students to translate simple conversations from English to Japanese and vice versa.
4. To make students aware about Japanese Culture and Customs.

**Course Outcomes:**

On completion of the course, learner will be able to --

- **CO1:** Have Japanese Communicative competence for primitive Social conversation in Japanese
- **CO2:** Comprehend Grammar of Japanese Script
- **CO3:** Translate simple sentences from Japanese to English and vice versa
- **CO4:** Be aware about Japanese society and people

### COURSE CONTENTS

<table>
<thead>
<tr>
<th>Unit I</th>
<th>Japanese Conversation</th>
<th>(02 hrs +04hrs Self Study)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Oral practice of conversation in situations such as declining an invitation, reporting an event, narrating a story, short formal speeches on occasions such as welcoming, introducing and thanking a guest, talking about Japanese and Indian festivals, hostel life etc

**Mapping of Course Outcomes for Unit I**

- **CO1**

<table>
<thead>
<tr>
<th>Unit II</th>
<th>Japanese Text and Kanji</th>
<th>(02hrs +04 hrs Self Study)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Diverse texts based on Japanese culture, customs, history, food habits, and science etc, for the development of communicative competence of students; skimming, scanning of texts with emphasis on advanced sentence patterns, grammatical structures and idiomatic phrases, reading and writing of approximately 400 kanji.

**Mapping of Course Outcomes for Unit II**

- **CO2, CO3**

<table>
<thead>
<tr>
<th>Unit III</th>
<th>Japanese Grammar and Composition</th>
<th>(02 hrs +04 hrs Self Study)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Basic sentence patterns to be applied in self introduction, identifying things; time of the day; calendar; counting using Japanese numerical classifiers; describing things; making comparisons; talking of daily activities; kinship terms used for address and reference; seasons; giving and receiving; shopping; making requests; talking of one’s likes and dislikes.
Mapping of Course Outcomes for Unit III

<table>
<thead>
<tr>
<th>CO2, CO3</th>
</tr>
</thead>
</table>

**Unit IV**
**Japanese – English Translation**
(02hrs +04 hrs Self Study)

Practice in English to Japanese and Japanese to English translation of short passages on various topics such as culture, society, religion and lifestyle taken from books, newspapers, magazines, internet etc.

Mapping of Course Outcomes for Unit IV

<table>
<thead>
<tr>
<th>CO3</th>
</tr>
</thead>
</table>

**Unit V**
**Language and Literature of Japan**
(02 hrs.)


Mapping of Course Outcomes for Unit V

<table>
<thead>
<tr>
<th>CO4</th>
</tr>
</thead>
</table>

---

E-Resources for Learning Support:

2. [https://www.freejapaneselanguagelessons.com/](https://www.freejapaneselanguagelessons.com/)
3. [https://minato-jf.jp](https://minato-jf.jp)/Japan Foundation

---

Text Books:


Reference Books:

1. Yukiko Ogata, Kana Sumitani, Yasuko Hidari, Yukiko Watanabe, Nihongo fun and Easy -II, Basic Grammar for Conversation

Evaluation:

Students should select any one of the above topic in a group of 3 to 5. Students should submit a written report and make a presentation on the topic. The task should not be repeated among students. Report will be evaluated by the faculty as per rubrics defined by him/her/them at start of course.
Savitribai Phule Pune University, Pune
Second Year Information Technology (2019 Course)
214459 (C): Mandatory Audit course 4: e-Waste Management and Pollution Control

Teaching Scheme: Credit Scheme: Examination Scheme:
01 hrs/week Non Credit course Audit Course

Prerequisite Courses: if any: --

Course Objectives:
1. To make the students aware about importance of environmental study.
2. To study impact of professional engineering products in societal contexts.
3. To understand impact of professional engineering products in environmental contexts.
4. To learn e-waste management and e-waste recycling process.
5. To understand causes, effects and control measures of environment pollutions.

Course Outcomes:
On completion of the course, learner will be able to --

CO1: Discuss various types of e-waste sources.
CO2: Understand impact of various e-wastes.
CO3: Identify characteristics of various e-Waste pollutants.
CO4: Understand process of e-Waste Recycling and relevant technologies.
CO5: Discuss causes, effects and control measures of different environment pollution.
CO6: Demonstrate Safe methods for disposal of e-waste and controlling the pollution.

COURSE CONTENTS

<table>
<thead>
<tr>
<th>Unit</th>
<th>E-Waste Overview and Sources</th>
<th>02 hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>e-waste Overview: What is e-waste, E-waste growth- An overview, hazards of e-waste Sources of e-wastes: Discarded computers, televisions. VCRs. stereos, copiers, fax machines, electric lamps, cell phones, audio equipment and batteries if improperly disposed.</td>
<td>02 hrs</td>
</tr>
</tbody>
</table>

Mapping of Course Outcomes for Unit I

<table>
<thead>
<tr>
<th>Unit</th>
<th>Impact of various e-wastes</th>
<th>02 hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>II</td>
<td>Solder in printed circuit boards, glass panels and monitors, Chip resistors and semiconductors, Relays and switches, Printed Circuit Boards, Cabling and computer housing, Plastic housing of electronic equipment and circuit boards, Front panel of CRTs, Motherboards.</td>
<td>02 hrs</td>
</tr>
</tbody>
</table>

Mapping of Course Outcomes for Unit II

<table>
<thead>
<tr>
<th>Unit</th>
<th>E-Waste pollutants and Characteristics</th>
<th>02 hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>III</td>
<td>Digital dump yard, how to minimize e-waste, Hazardous substances waste Electrical and Electronic Equipment, characteristics of pollutants, batteries, electrical and electronic</td>
<td>02 hrs</td>
</tr>
</tbody>
</table>
components, plastic and flame retardants, circuit boards, pollutants in waste electrical and electronic equipment.

<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit III</th>
<th>CO3</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>E-Waste Recycling</th>
<th>02 hrs</th>
</tr>
</thead>
</table>

Unit IV

Overview of e-Waste recycling. Technologies for recovery of resources from electronic waste, resource recovery potential of e-waste, steps in recycling and recovery of materials - mechanical processing, technologies for recovery of materials

<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit IV</th>
<th>CO4</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Environmental Pollution</th>
<th>02 hrs</th>
</tr>
</thead>
</table>

Unit V

Causes and effects and control measures of: Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, nuclear hazards, Role of an individual in prevention of pollution, Pollution case studies: Pollution caused because of electronic waste material and measures for controlling.

<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit V</th>
<th>CO5</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Impact on human health and Pollution Controlling</th>
<th>02 hrs</th>
</tr>
</thead>
</table>

Unit VI


<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit VI</th>
<th>CO6</th>
</tr>
</thead>
</table>

E-Resources from Learning Support

1. https://nptel.ac.in/courses/105/105/105105169/

<table>
<thead>
<tr>
<th>Text Books</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Reference Books</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Evaluation:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students should select any one of the above topic in a group of 3 to 5. Students should submit a written report and make a presentation on the topic. The task should not be repeated among students. Report will be evaluated by the faculty as per rubrics defined by him/her/them at start of course.</td>
</tr>
</tbody>
</table>
Savitribai Phule Pune University, Pune
Second Year Information Technology (2019 Course)

214459 ( D ): Mandatory Audit course 4 :
Intellectual Property Rights

Teaching Scheme: 01hrs/week  Credit Scheme: Non Credit  Examination Scheme: Audit Course

Prerequisite Courses, if any: ---

Course Objectives
1. To introduce fundamental aspects of Intellectual property Rights (IPR)
2. To disseminate knowledge about types of IP like Patents, Copyrights, Trade Secrets
3. To make students aware about current trends in IPR and their importance
4. To motivate students for innovative thinking and making inventions

Course Outcomes
On completion of the course, learner will be able to --

CO1: Exhibit the concepts of Intellectual Property Rights
CO2: Differentiate among different IPR
CO3: Formulate and characterize innovative ideas and inventions into IPR
CO4: Demonstrate knowledge of advances in patent law and IP regulations

COURSE CONTENTS

<table>
<thead>
<tr>
<th>Unit I</th>
<th>Overview Of Intellectual Property</th>
<th>02 hrs</th>
</tr>
</thead>
</table>

Mapping of Course Outcomes for Unit I CO1, CO2

<table>
<thead>
<tr>
<th>Unit II</th>
<th>Patents</th>
<th>04 hrs</th>
</tr>
</thead>
</table>

Mapping of Course Outcomes for Unit II CO3, CO4

<table>
<thead>
<tr>
<th>Unit III</th>
<th>Copyrights</th>
<th>02 hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concept of Copyright –Copyright Subject matter: original literary, dramatic, musical, artistic works; cinematograph films and sound recordings - Registration Procedure, Term of protection, Ownership of copyright, Assignment and license of copyright - Infringement</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Mapping of Course Outcomes for Unit III CO3

SE (Information Technology) Syllabus (2019 Course)
<table>
<thead>
<tr>
<th>Unit IV</th>
<th>Trademarks</th>
<th>02 hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nature of Trademarks - Different kinds of trademarks (logos, signatures, symbols, well known marks, brand names, certification and service marks) – Trademarks that can’t be registered– Trademarks registration procedure - Rights of holder and assignment and licensing of marks - Infringement</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit IV</th>
<th>CO3</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Unit V</th>
<th>Advances in IP Laws and Government policies</th>
<th>02 hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Amendments and India’s New National IP Policy, Promoting IPR policy for Start-ups, Career Opportunities in IP - IPR in current scenario</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mapping of Course Outcomes for Unit V</th>
<th>CO4</th>
</tr>
</thead>
</table>

### Text Books

### Reference Books

### Evaluation:
Students should select any one of the above topic in a group of 3 to 5. Students should submit a written report and make a presentation on the topic. The task should not be repeated among students. Report will be evaluated by the faculty as per rubrics defined by him/her/them at start of course.